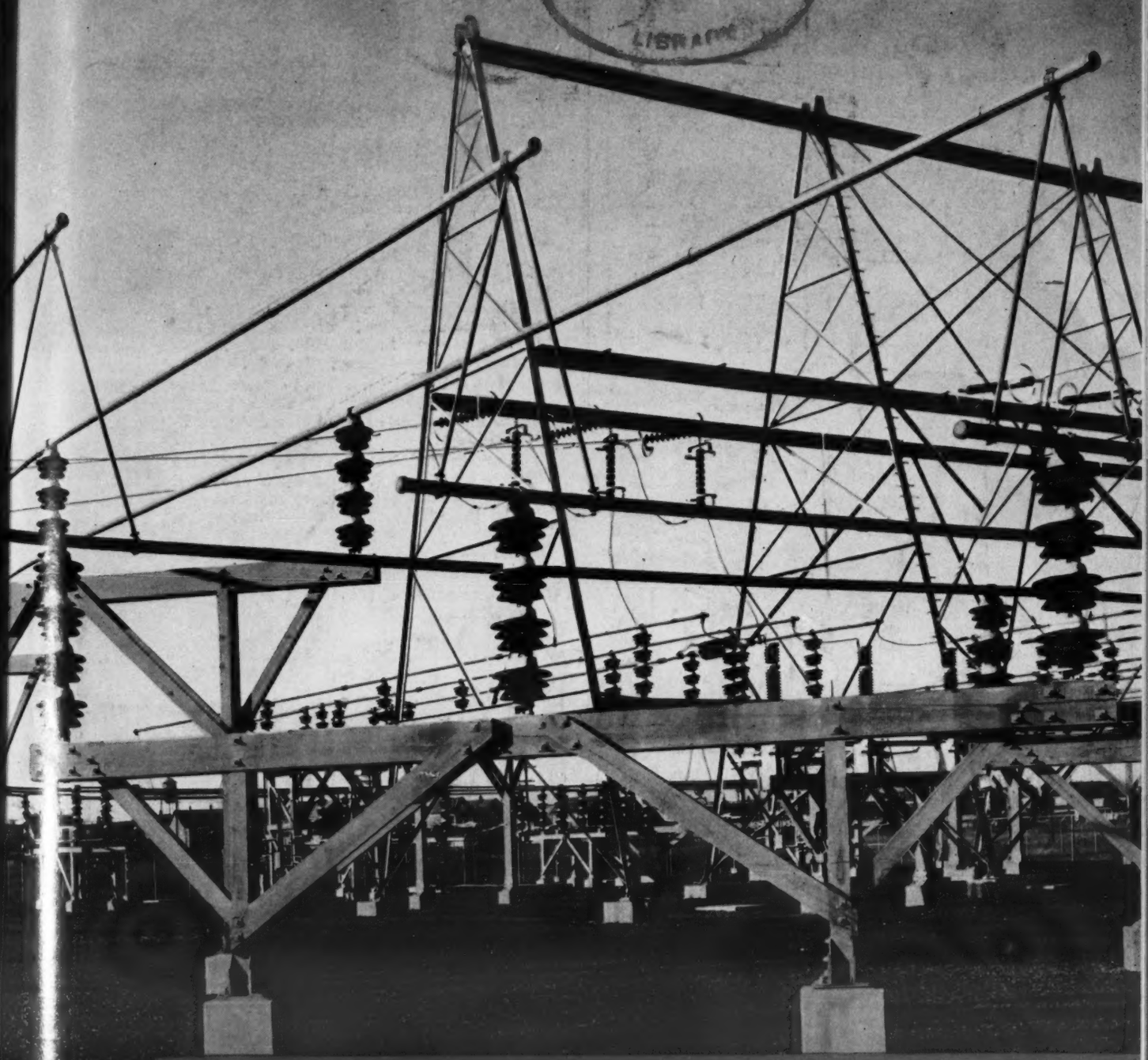
Electrical World

JUNE 12, 1943

JUL 25 19
LIBRARY

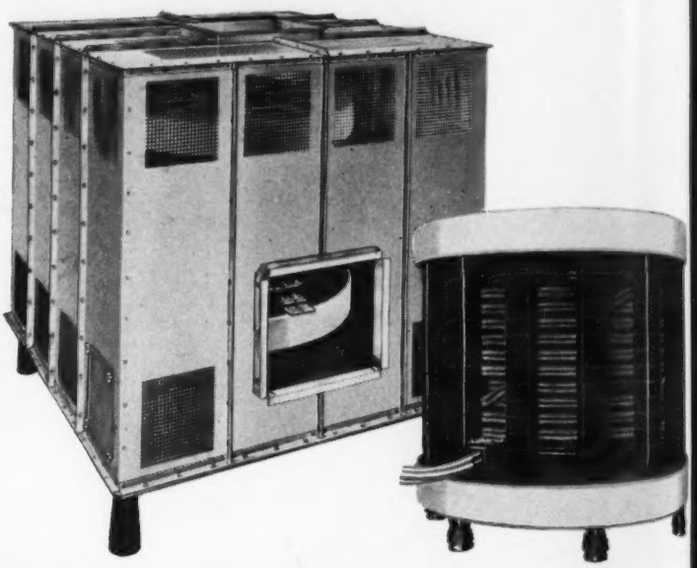


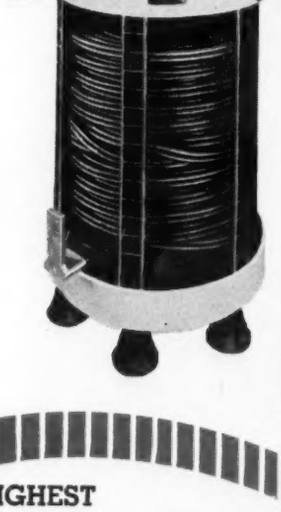
WOOD, IRON PIPE REDUCE STEEL, COPPER REQUIREMENTS

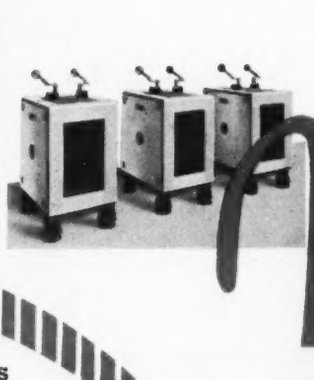
Lessen the THREAT of

power flow INTERRUPTIONS!

UNIVERSITY OF CA
JUN 25 1
LIBRARY







THE ability of Murray Current Limiting Reactors to withstand severe short circuit conditions is a matter of record—since the first one was built in 1910. Their reliability and sturdiness have been proved—unquestionably.

Murray Reactors are "hand-tailored" to meet definite characteristics of the particular system. And if available space for their installation is limited as in crowded plants, their size is determined to suit the conditions.

Service records of Murray Low Loss Reactors disclose the clearing of the most severe short circuits, with the resultant saving of thousands of dollars in plant equipment, maintenance and operation.

Be prepared with Murray Reactors—their installations pays and pays well.

Metropolitan Device Corporation, Brooklyn, N. Y.

OTHER MURRAY DEVICES

Aerial Ladder
Cable Racks
Malleable Strapping
Meter Boxes
Meter Seals
Meter Switches
Panelboxes
Safety Switches
Testing Devices
Wiring Troughs

HIGHEST
All-Year Efficiencies

HIGHEST
Short Circuit Protection

LOWEST
Temperature Rises

Murray

—the foremost name on current-limiting

REACTORS

Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

June 12, 1943

Vol. 119, No. 24

Contents

Switching Station Modified to Save Copper and Steel 64
P. H. ADAMS, Public Service Electric & Gas Company

Set Industry War Bond Record 67

Electrical Application of New Thermoplastics 69
T. S. CARSWELL and TURNER ALFREY, Jr., Monsanto Chemical Company

Capacitor of 5,000-Kva. for Substation Regulation 72
W. W. PERRY, New York State Electric and Gas Corporation, and
D. M. UMPHREY, Westinghouse Electric & Manufacturing Company

Board Tests Single- and Polyphase Meters 75
C. IATONNA, Pennsylvania Power Company

Wicket Gates Eliminated in Low-Cost Waterwheel Governor 76

Priorities Problems 78

Editorials ..... 63 and 80

Washington Comment 82

News of the Week 83

How 92

Load Servicing 126

New Equipment 136

News About People 141

Manufacturing and Markets 152

Sales Opportunities 158

Recent Legislation and Recent Rate News 161

Letter to the Editor 162

Book Reviews 165

Index of Advertisements 168

UNIVERSITY OF CALIFORNIA
JUN 25 1943
LIBRARY

S. B. WILLIAMS ..... *Editor*

FRANK R. INNES ..... *Managing Editor*
A. E. KNOWLTON ..... *Associate Editor*
LAURENCE WRAY ..... *News Editor*
R. M. SHOOP ..... *Assistant Editor*
E. M. GLENNON ..... *Assistant News Editor*
D. T. BRAYMER ..... *Western Editor*
H. S. KNOWLTON ..... *New England Editor*
GEORGE C. TENNEY ..... *Pacic Coast Editor*
R. N. LARKIN ..... *Washington Correspondent*

W. K. BEARD, Jr. ..... *Publisher*

DISTRICT MANAGERS
E. F. COFFEY ..... New York
N. V. PALMER ..... Boston
W. K. BEARD ..... Philadelphia
F. P. COYLE ..... Philadelphia
C. R. LIPPOLD ..... Cleveland
S. H. BABCOCK ..... Detroit
G. J. SEAMAN ..... Chicago
G. G. SEARS ..... St. Louis

ELECTRICAL WORLD

Published weekly. Price 25 cents a copy. Allow at least ten days for change of address. Address communications about subscriptions to Director of Circulation, Electrical World, 330 West 42nd Street, New York, N. Y.

RETURN POSTAGE GUARANTEED

Subscription rates: In the United States, Mexico, Central and South American countries, $5 a year, $8 for two years, $10 for three years. Canada $5.50 for one year, $9 for two years, $11 for three years (Canadian money at par). Great Britain and British possessions, 54 shillings for one year, 108 shillings for three years. All other countries $9 for one year, $18 for three years. Entered as second-class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Contents copyrighted, 1943, by McGraw-Hill Publishing Company, Inc.

Branch Offices: 520 North Michigan Avenue, Chicago; 68 Post Street, San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington, Philadelphia, Cleveland, Detroit, St. Louis, Boston, Los Angeles, Atlanta, Ga.

McGRAW-HILL PUBLISHING CO., INC.
JAMES H. McGRAW
Founder and Honorary Chairman

Publication Office
99-129 North Broadway, Albany, N. Y.
Editorial and Executive Offices
330 West 42nd Street, New York, N. Y.
JAMES H. McGRAW, Jr. ..... President
HOWARD EHRLICH ..... Executive Vice-President
MASON BRITTON ..... Vice-President
B. R. PUTNAM ..... Treasurer
JOSEPH A. GERARDI ..... Secretary
J. E. BLACKBURN, Jr. ..... Director of Circulation
Member A.B.P. Member A.B.C.
Cable Address McGRAWHILL, New York

The contents of this issue are copyrighted and may not be reproduced without the permission of the copyright owner.

CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY
330 West 42nd Street, New York, N. Y.
Director of Circulation:

Please change my address on Electrical World

From .....

.....

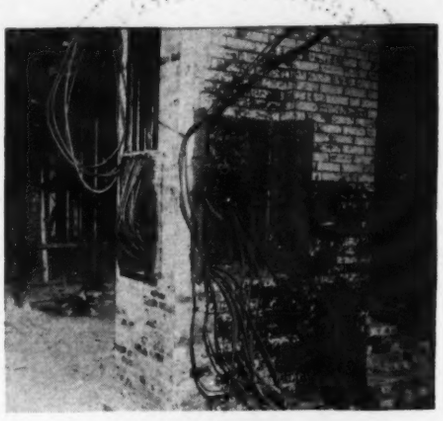
To .....

.....

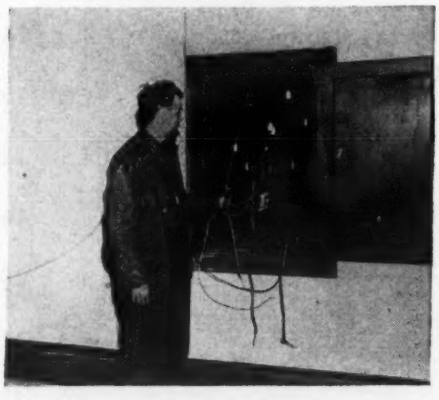
Signed .....

GOOD WIRING PAID

twice!



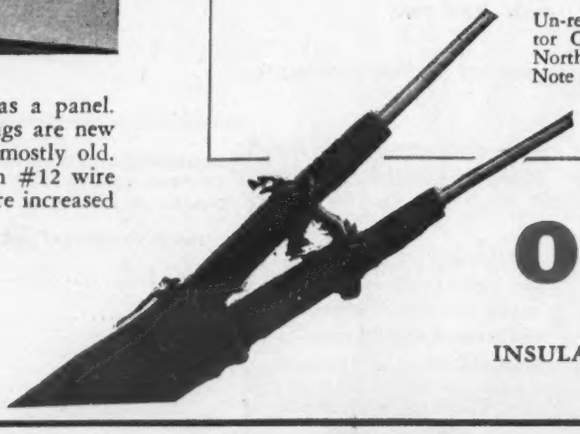
• New and old junction boxes for the riser cables are side by side. "This building had an unusual first-class job of old-fashioned wiring and as a result we were able to use a good deal of it," said the electrical contractor.



• Each end of each floor has a panel. Receptacles, switches and plugs are new but the lighting circuits are mostly old. (90% of the old circuits with #12 wire were reused.) The outlets were increased three for one.

IN 1907 the Chicago & Northwestern Railroad wired its then new office building in Chicago with Okonite cable. Recently the company modernized this building and the initial cable and its installation were so good that the original wire, after more than 35 years of service, was used again in all the circuits! An inspection of the original cable showed that the tinning on the conductors was very good, with no bare copper visible; the Okonite insulation was in excellent condition; the wire insulation was flexible and could be bent upon itself without cracking or injury and that the braids over the conductors, as well as the outside braid, were strong and well saturated.

The Chicago & Northwestern Railroad, in selecting a *good* wire 35 years ago, is now benefiting by using it again at a time when it also makes a valuable contribution to our country's war effort in the conservation of critical materials. Good wiring — Okonite wiring — pays! And in this instance it paid twice! . . . The Okonite Company, Passaic, New Jersey. Offices in principal cities.



Un-retouched cut-back section of #12 twin conductor Okonite wire removed from the Chicago & Northwestern office building after 35 years' use. Note its excellent condition.

OKONITE

INSULATED OKONITE WIRES & CABLES

3318

...IS ALSO A *"Fighting Word"*

to Graybar's Utility Supply-Corps

Floods, storms and other "natural" disasters are no less dangerous than enemy action when they disrupt the lines that carry the power-to-win. That's why GRAYBAR – despite restrictions on its everyday service to the utility industry – has proved itself mobilized and ready when sudden emergencies strike.

Recent Mid-west floods, for example, brought GRAYBAR'S supply service on line-construction items into action *fast*. Our network of warehouses, within and without the flooded area, was able to rally badly needed supplies and rush them to points of greatest need.

Technical understanding of utility needs helped get the orders out with fewer questions and delays. When the product ordered was unavailable, we knew the serviceable alternates without being coached. Transport experience in other floods and emergencies helped GRAYBAR to get its shipments through.

From this emergency experience—as from GRAYBAR'S entire wartime supply job – will come new capabilities to serve you well in peacetime.

Executive Offices:
GRAYBAR BUILDING
New York, N. Y.

GraybaR

IN OVER 80 PRINCIPAL CITIES

*GraybaR Since 1869 *REG. U.S. PAT. OFF. Everything Electrical . . . THAT IT TAKES TO WIN!

Chalk up another home run!

When good men and good equipment get together, results are pretty sure. Uncle Sam's subs are proving it.

For a good many years now, Elliott has been building electrical equipment for the Navy, with special emphasis on generators and main propulsion motors for submarines. It gratifies the men of Elliott Company to feel that these Elliott-built units are now helping Uncle Sam's subs to make good scores.

In these motors and generators, the limitations on weight and dimension are such that the most skillful engineering is required. The result is more kw. and hp. per pound than is ever achieved commercially. All steel is stressed to the maximum with respect to magnetic and electrical qualities. All other metals except conductors wherever possible are of aluminum alloy or other light material. Comparatively, it is easy to design a motor of normal dimensions for a given hp., but it needs exceptional skill and experience to meet the limitations imposed in these jobs.

That same skill and experience is building an enviable reputation not only for Elliott motors and generators, but also for the entire line of Elliott power plant and process equipment.

The Army-Navy "E" has been awarded to both the Jeannette and the Ridgway plants of Elliott Company.

ELLIOTT COMPANY

Electric Power Department, **RIDGWAY, PA.**

DISTRICT OFFICES IN PRINCIPAL CITIES

ELLIOTT MOTORS and GENERATORS

ONE OF AMERICA'S GREAT BUILDERS OF POWER AND PROCESS EQUIPMENT

CHECK the FACTS

1. Maximum strength, with proper use of restricted materials.
2. Clamping surfaces designed to maintain constant clamping pressure.
3. Can be supplied with class A, B or D insulators, using high strength, all glazed porcelain (class B shown).
4. Hardware attached with resilient alloy in place of cement, eliminating spot loading.
5. R&IE assembly assures uniformity in strength, dimension and appearance.

UNIVERSITY OF CALIFORNIA
JUN 25 1943
LIBRARY

R&IE

BUS SUPPORTS

The Check list

- CONDUCTOR SUPPORTS CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- AIR BREAK SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

AILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

We're in the Same Boat

Let's pull together

You are at capacity right now. So are we. But when the war ends, and peak production stops you'll need *plenty* of business to take up the slack. So will we.

We're *doing something* about it

We are advertising consistently to hotels, restaurants, bakeries, hospitals, and institutions, selling the idea of planning *now* to install Hotpoint-Edison Commercial Cooking Equipment after the war. This will result in an increased use of current by your commercial customers . . . just at the time you most need the business to help offset the sudden drop in load from peak war production.

Electric cooking will have further impetus at the end of the war. Thousands of chefs, cooks and bakers now in the armed forces are learning how dependable, safe, simple and clean Hotpoint-Edison electric cooking is. They are sold on this modern method.

Pull an oar with us!

Your post war revenue from commercial customers can be greatly increased if you cooperate *now*, pushing the idea of electric cooking after the war . . . in your own advertising, promotion material, and contacts. Edison General Electric Appliance Co., Inc., 5618 West Taylor Street, Chicago, Illinois.

For outstanding achievement in War Production

FOUND ONLY IN MODERN KITCHENS

Hotpoint Edison

COMMERCIAL ELECTRIC COOKING EQUIPMENT

BOSTON NEW YORK CITY ATLANTA CLEVELAND CHICAGO KANSAS CITY
DALLAS LOS ANGELES SEATTLE SALT LAKE CITY
CANADA—Canadian General Electric Company, Ltd., Toronto

OLDEST AND LARGEST MAKER OF ELECTRIC COOKING EQUIPMENT

FOR VICTORY — BUY U. S. WAR BONDS AND STAMPS

TWINS MAY *Look* ALIKE

BUT THEY DON'T *Act* ALIKE!

Some of us can't tell identical twins apart, but if you know them intimately you generally find differing personalities. Frequently one is stronger and healthier than the other--even though they may *look* alike!

Another case of "identical twins" would be two station insulators of different manufacture. They are exactly alike in physical qualities and appearance. But they, too, have personalities--some stronger and healthier than others.

A lot of the strength and health and personality of station insulators is a family inheritance. O-B insulators come from good stock...The same fine materials, manufacturing methods, and human skill that go into O-B suspensions, pintypes, and bushings are present in O-B station insulators. They are good because they come of a good family; a fact that is generally recognized throughout the electrical industry.

Another fact, still more important, is that most purchases of O-B station insulators are made by previous users who have learned for themselves that there's a lot under the skin of an insulator--that they *aren't* all alike, and that those branded with "O-B" will take what comes and keep delivering the goods

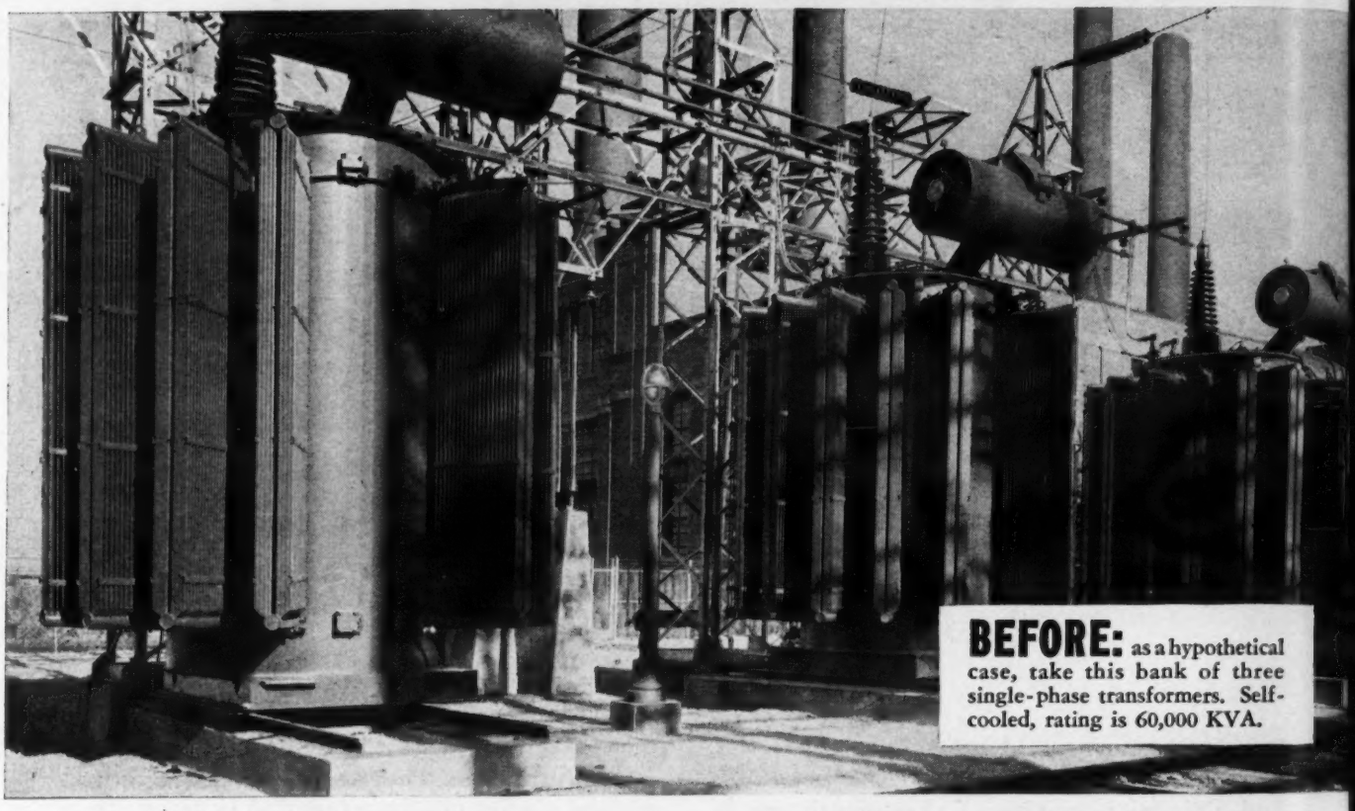
You can assume correct size and shape in any station insulator, but if you want those hard-to-get intangibles that can't be specified, merely write "O-B" on your order.

Ohio Brass

MANSFIELD, OHIO 2435-H

Canadian Ohio Brass Campany, Ltd., Niagara Falls, Ont.

JUMP CAPACITY OF PRESENT BY ADDING ALLIS-CHALMERS' IT'S THE COMING THING



BEFORE: as a hypothetical case, take this bank of three single-phase transformers. Self-cooled, rating is 60,000 KVA.

★By accelerating flow of oil with pump action—and by forcing cooling air over radiator surfaces — ELECTRO-COOLERS jump transformer capacities!

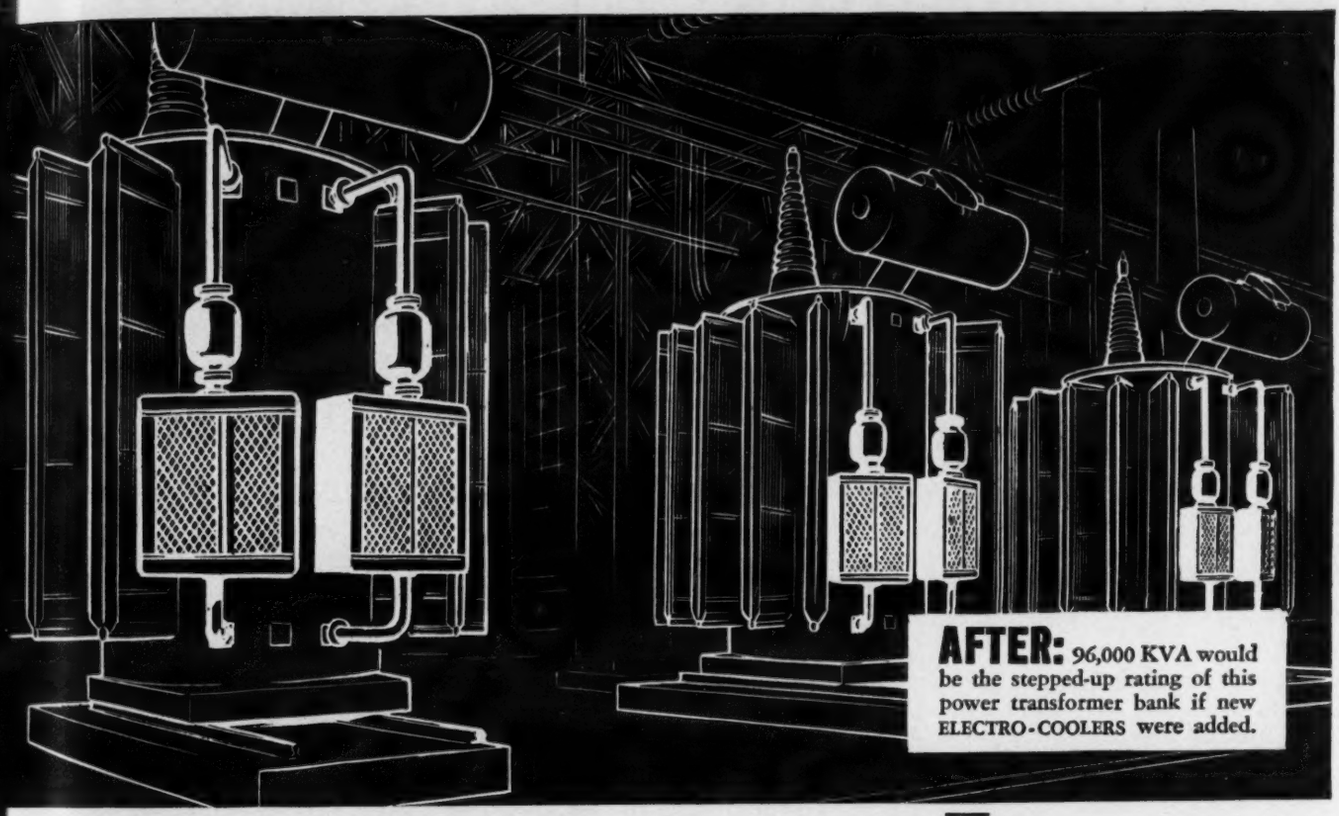
★New transformers built with ELECTRO-COOLERS use 25% less copper and steel than formerly... cost less!

★New ELECTRO-COOLER is self-lubricating... employs no stuffing boxes... is outstandingly simple and sturdy. Here's a sound long-term investment!

A 1614

ALLIS-CHALMERS

POWER TRANSFORMERS 20-60% GREAT NEW ELECTRO-COOLER. IN FORCED-OIL COOLING!



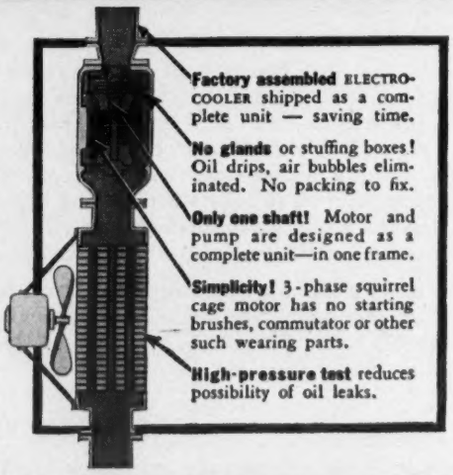
AFTER: 96,000 KVA would be the stepped-up rating of this power transformer bank if new ELECTRO-COOLERS were added.

HERE'S A WARTIME investment with a great peacetime future... Allis-Chalmers' important new ELECTRO-COOLER. It can step up capacities of most existing power transformers 20-60%!

Installation is simple... because the new ELECTRO-COOLER is self-contained and self-supporting, takes little room, does not require new foundations.

Note at the right how simple and *practical* the new ELECTRO-COOLER is! Motor and pump are built on one shaft and in one frame — are self-lubricated. There are *no* stuffing boxes!

If your transformers are peak-loaded —and you still face increasing loads— get in touch with our nearby office for all facts about the new ELECTRO-COOLER. Or write for Bulletin B-6242. ALLIS-CHALMERS, MILWAUKEE, WIS.



Factory assembled ELECTRO-COOLER shipped as a complete unit — saving time.

No glands or stuffing boxes! Oil drips, air bubbles eliminated. No packing to fix.

Only one shaft! Motor and pump are designed as a complete unit—in one frame.

Simplicity! 3-phase squirrel cage motor has no starting brushes, commutator or other such wearing parts.

High-pressure test reduces possibility of oil leaks.

TRANSFORMERS

ALLIS-CHALMERS AC MILWAUKEE

WE WORK FOR VICTORY

WE PLAN FOR PEACE

WISSCO

ARMATURE BINDING WIRE

Tinned, high tensile wire available in all grades

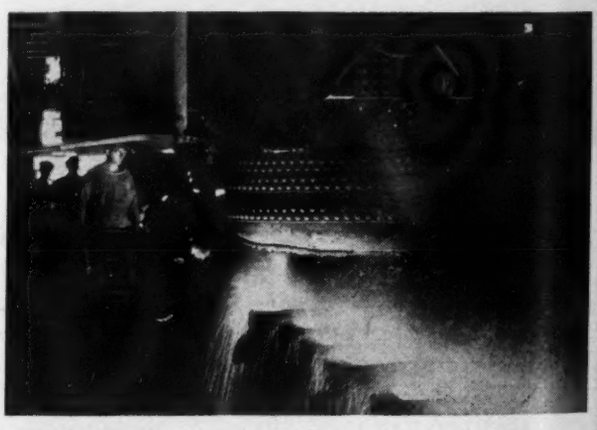
Prompt deliveries

Plus Everything in Wire

Here at wire headquarters you will find everything you need, not only *Wissco quality* Armature Binding Wire, but high and low carbon steel wire—round, flat or shaped . . . wire for springs and for hundreds of other applications, in a variety of sizes, tempers, grades and finishes.

Back of every inch of it is all the skill acquired in 122 years of research, discovery and pioneering—the things which have made Wissco one of the world's leading specialists in wire. The thousands of Wickwire Spencer workmen are breaking all-time records in producing Wissco wire for Victory needs, watching every step as it goes through our blast furnaces, open hearths and wire mills on its way for use in war equipment—and for maintaining our civilian economy.

If you have a wire need, put it up to experts. Wickwire Spencer Steel Company, 500 Fifth Avenue, New York (18): Buffalo, Chicago, Detroit, Philadelphia, San Francisco, Worcester.



FROM A TO Z every step in the manufacture of Wissco wire, from ore pile to finished product, is taken right in our own mills. That's one reason for the *uniformity* for which Wissco wire is famous.

SEND YOUR WIRE QUESTIONS TO WICKWIRE SPENCER

WISSCO WIRE

BY WICKWIRE SPENCER

WISSCO PRODUCTS

New ELECTRIC *air cleaner*

ENDS OIL MIST HAZARD FOR INDUSTRY

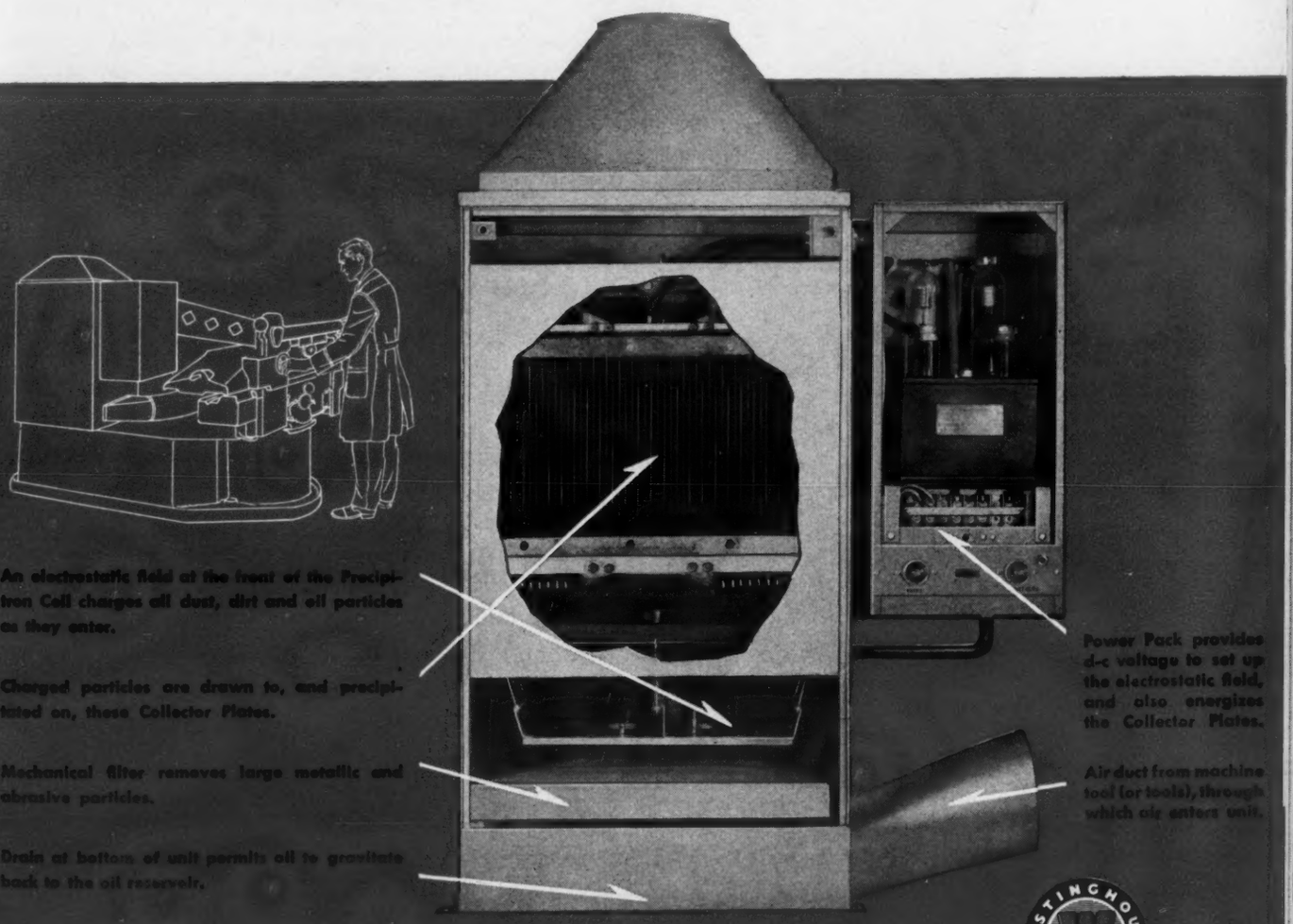
Cutting oil, so vital to the manufacture of precision parts, has created a dangerous hazard in many war plants. Vaporizing at the machines, the coolants fill whole departments with oil mist. This oil adheres to lighting fixtures, bus ducts and wiring, creating a serious fire hazard and nuisance.

In various war plants throughout the country, PRECIPITRON*—the Westinghouse Electric Air Cleaner—is eliminating this oil mist as if by magic. The mist is captured at its source and the cleaned air recirculated through the shop. And the oil removed from the air is salvaged—as much as 100 gallons a day in one midwestern war plant.

*Trade-mark registered in U. S. A.

Now available in a self-contained unit for use with individual machine tools, Precipitron thus adds one more important job to the many it is doing toward speeding the nation's war effort. Because it cleans the air electrically and is able to capture more than 90% of all air-borne particles down to 1/250,000 of an inch in diameter, it has brought a new meaning to industrial air cleaning. For full information on Precipitron and its many wartime applications, get in touch with your nearest Westinghouse Office. Or write Westinghouse Electric & Manufacturing Company, Edgewater Park, Cleveland, Ohio, for booklet B-3267.

TUNE IN JOHN CHARLES THOMAS, NBC, SUNDAYS, 2:30 P. M., E. W. T.


An electrostatic field at the front of the Precipitron Cell charges all dust, dirt and oil particles as they enter.
Charged particles are drawn to, and precipitated on, these Collector Plates.
Mechanical filter removes large metallic and abrasive particles.
Drain at bottom of unit permits oil to gravitate back to the oil reservoir.
Power Pack provides d-c voltage to set up the electrostatic field, and also energizes the Collector Plates.
Air duct from machine tool (or tools), through which oil enters unit.

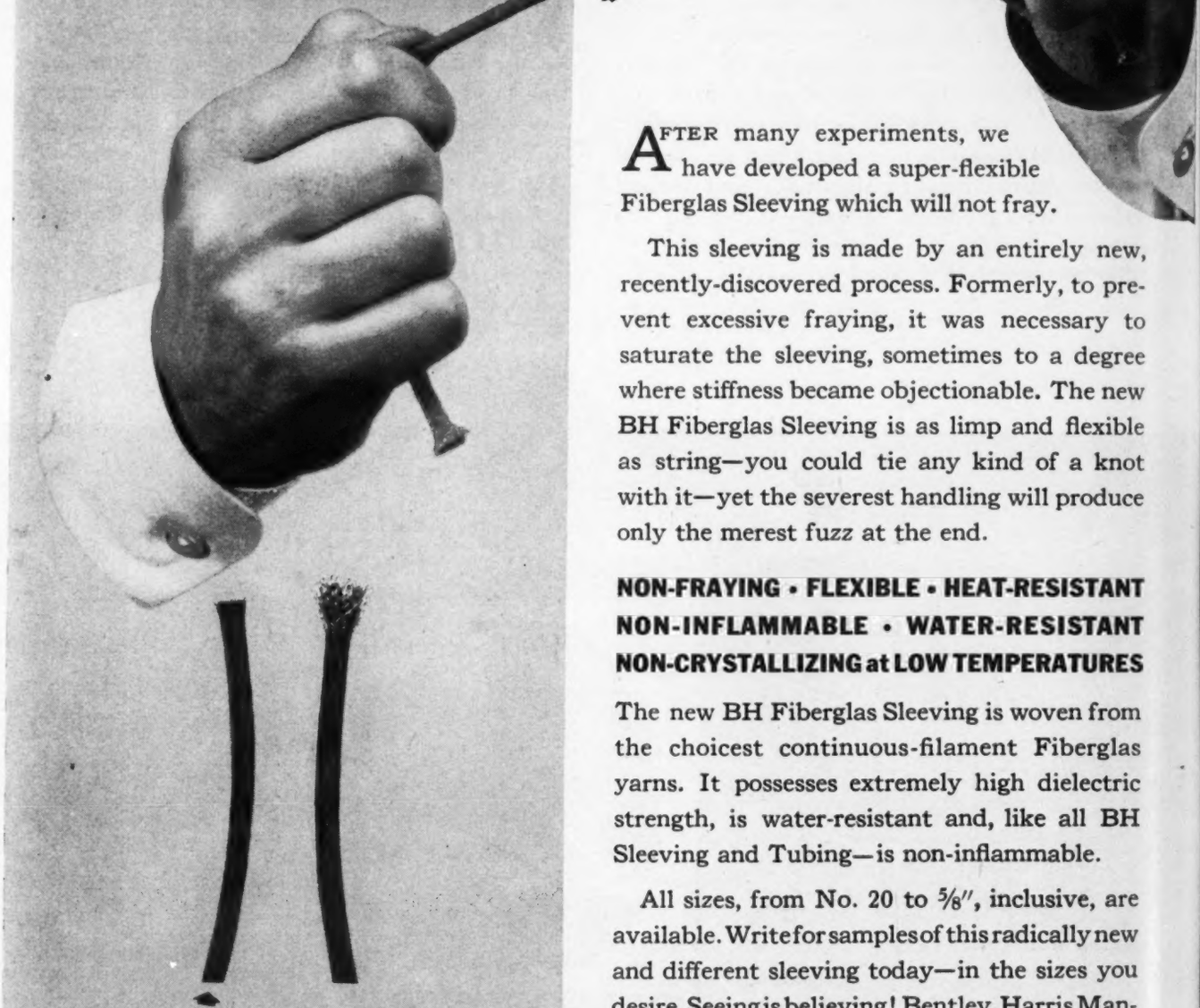
Westinghouse Precipitron

PLANTS IN 25 CITIES ... OFFICES EVERYWHERE

Electronics at Work

AT LAST!

A New Sleeving— Flexible as String and Non-Fraying



THIS — NOT THIS

AFTER many experiments, we have developed a super-flexible Fiberglas Sleeving which will not fray.

This sleeving is made by an entirely new, recently-discovered process. Formerly, to prevent excessive fraying, it was necessary to saturate the sleeving, sometimes to a degree where stiffness became objectionable. The new BH Fiberglas Sleeving is as limp and flexible as string—you could tie any kind of a knot with it—yet the severest handling will produce only the merest fuzz at the end.

NON-FRAYING • FLEXIBLE • HEAT-RESISTANT
NON-INFLAMMABLE • WATER-RESISTANT
NON-CRYSTALLIZING at LOW TEMPERATURES

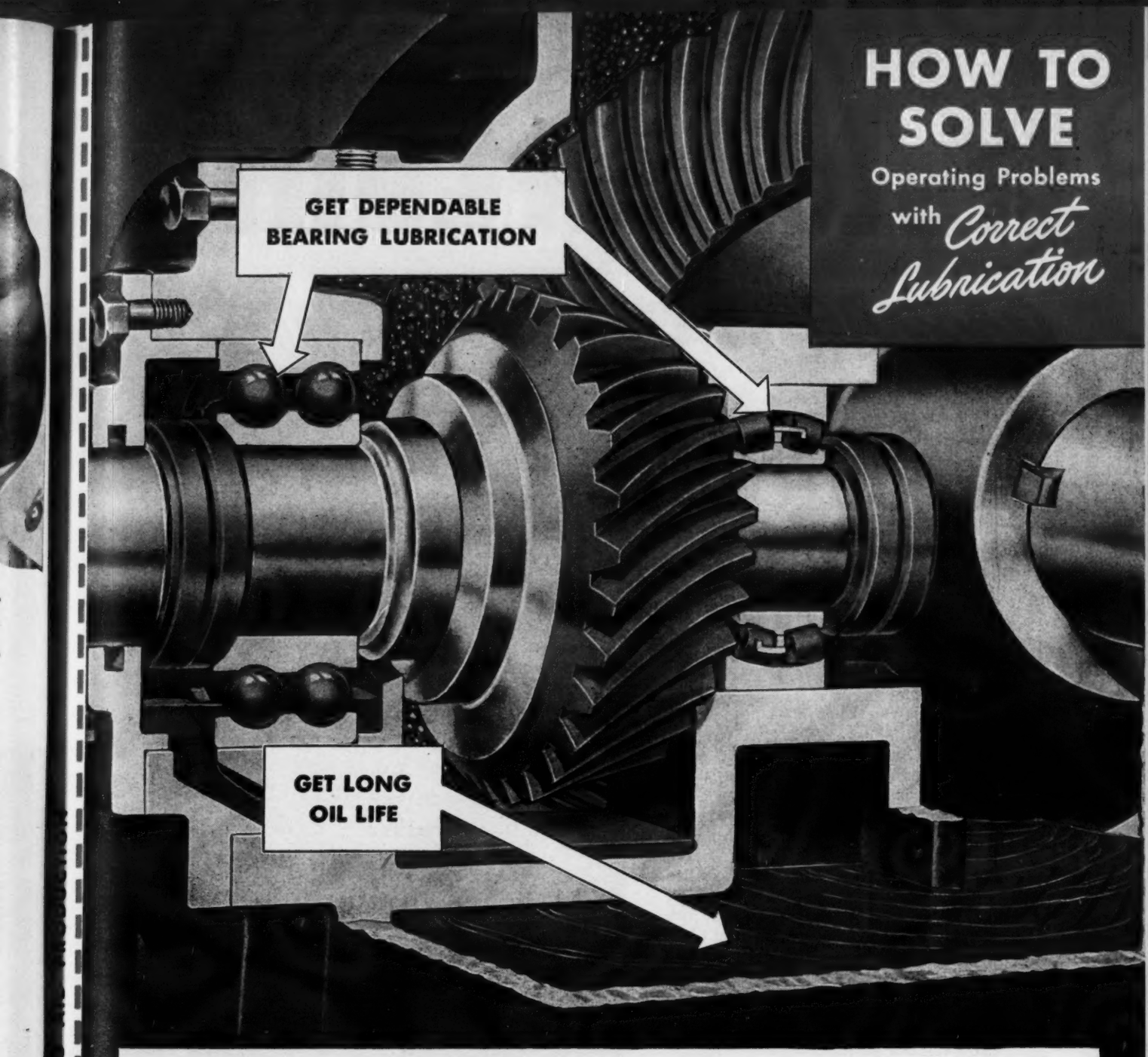
The new BH Fiberglas Sleeving is woven from the choicest continuous-filament Fiberglas yarns. It possesses extremely high dielectric strength, is water-resistant and, like all BH Sleeving and Tubing—is non-inflammable.

All sizes, from No. 20 to 5/8", inclusive, are available. Write for samples of this radically new and different sleeving today—in the sizes you desire. Seeing is believing! Bentley, Harris Manufacturing Co., Dept. W, Conshohocken, Pa.

BH PRODUCTS

NON-BURNING IMPREGNATED MAGNETO TUBING • NON-BURNING FLEXIBLE VARNISHED TUBING • SATURATED AND NON-SATURATED SLEEVING

BENTLEY, HARRIS MANUFACTURING CO.
Conshohocken, Penna.



HOW TO SOLVE

Operating Problems with *Correct Lubrication*

Reduce Wear_Get a *Plus*, too

OF COURSE YOU WANT gear tooth wear kept to a minimum! Gargoyle Vacuoline Oil will help you do that in a splash or circulation oiling system. It forms an oil film of high lubricity and great strength.

But can you get more, too? What about the LIFE OF THE OIL? Does the oil you use separate easily from water? Is it free from emulsions and sludge? WHAT ABOUT THE BEARINGS? Does the oil you use protect them from damaging rust?

Here's the point: Gargoyle Vacuoline Oil does not only minimize wear. *It also minimizes rusting danger* in the bearings. *And it lasts long.*

Yes, by all means, *insist* on an oil that reduces tooth wear—but get the "plus" of long bearing life, long oil life by using Gargoyle Vacuoline Oil.

GARGOYLE
Lubricants

SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Magnolia Petroleum Company • General Petroleum Corporation of California

CALL IN SOCONY-VACUUM

It's Motor Control

assures Fast Interruptions and Fast Reclosures

PACIFIC ELECTRIC Breakers Offer... RELIABLE SERVICE, LOW MAINTENANCE

Type RWE, 115 to 287-kv.

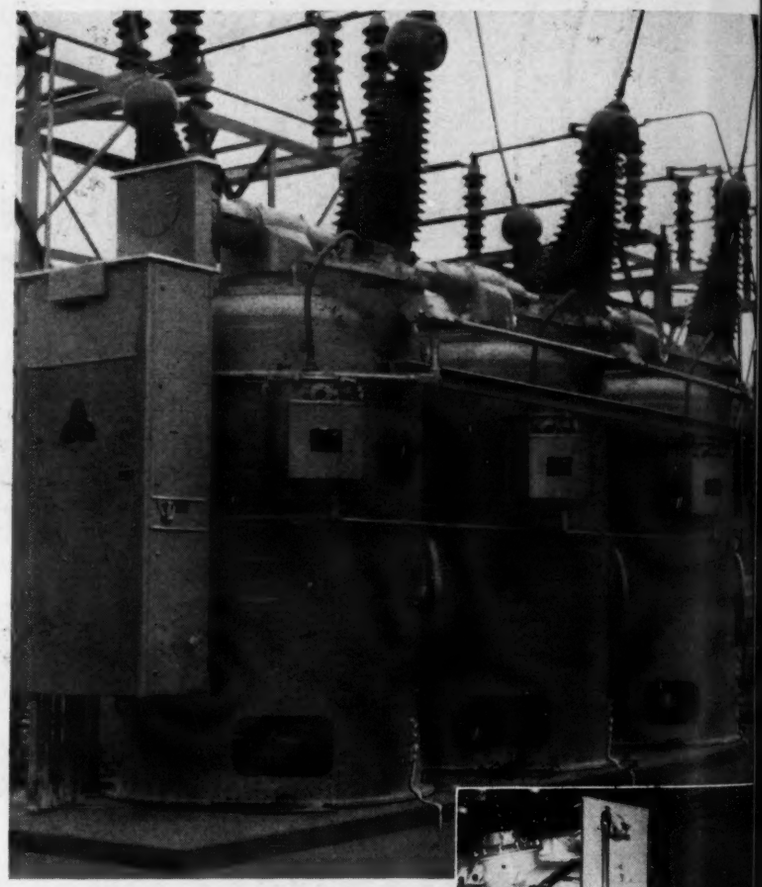
When operating energy is *stored* in a strong spring, you are assured of reliable, *fast* interruptions and reclosures.

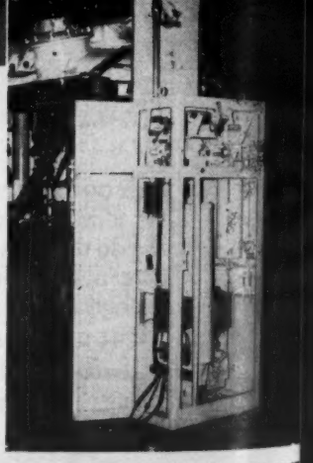
Storing operating energy this way in Pacific Electric Breakers, simplifies the design—there are no expensive station batteries, no heavy cables, no short-life rectifiers, no air compressor. The spring is automatically motor-wound from low AC or DC current. You have manual closing as fast as electrical, and perfect synchronizing because of the constant operating speed.

Another thing, there are 6 breaks per pole, with Expulsion Chambers which extinguish arcs quickly.

Fast operation plus fast arc extinguishment save contacts, save oil deterioration, reduce tank pressures and offer more reliability at lower maintenance. This has proved true at hundreds of Pacific Electric Breaker installations of this type the nation over.

Made by the Pacific Electric Mfg. Corporation, for 37 years specialists in high-voltage switching equipment, you will plan *more for your money* and *full protection* by figuring on these rugged Pacific Electric Breakers with the motor-wound spring-actuated Motor Control which assures fast interruptions and fast reclosures.





Above: Type RWE, 115-kv. Oil Circuit Breaker with Type MH-3 Motor Control. Lower insert: Shop view with doors open for testing of the MH-3 Automatic Motor-Wound Spring-Actuated Control.

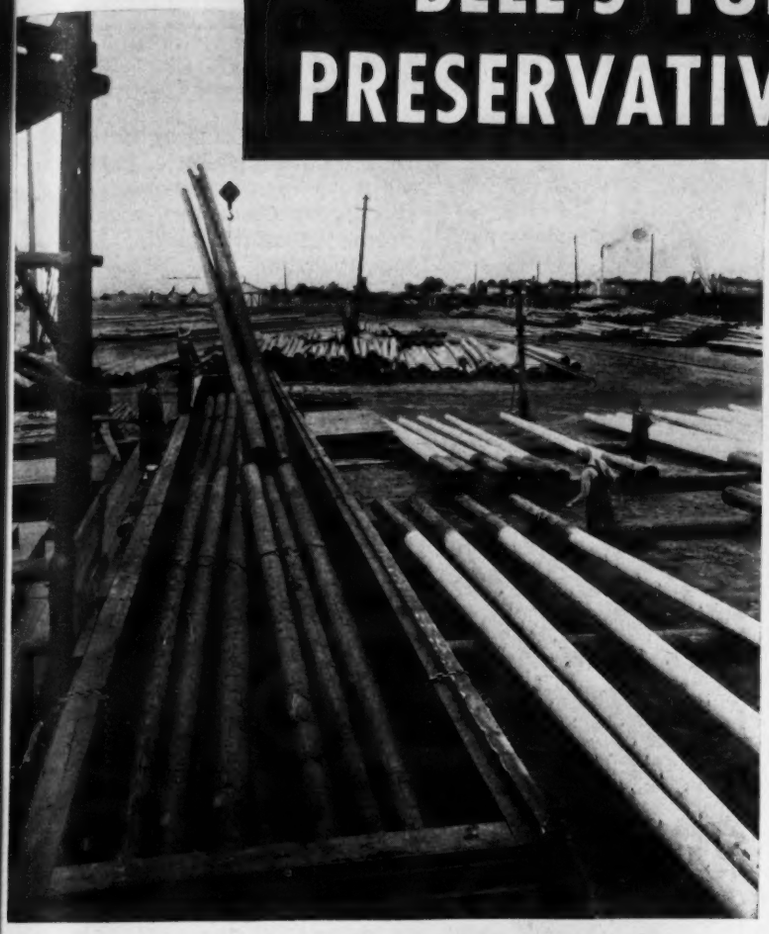
C. H. Cutter
1015 Securities Bldg.
Seattle, Wash.
G. B. Kirkwood
437 S. Hill St.
Los Angeles, Calif.

J. E. Redmond Co.
448 W. Madison St.
Phoenix, Ariz.
Other Representatives in Principal Cities

Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO, CALIF. DUNES HIGHWAY, GARY, INDIANA

BELL'S FULL LENGTH PRESERVATIVE TREATMENT



Adds Service Life to Cedar Poles

The BELL organization, using Selkirk Range High Altitude Western Red Cedar, besides furnishing transmission and distribution line poles with butt treatment only, also provides poles through an additional specially developed process . . . (1) poles that are absolutely smooth (2) that have all knots shaved level with the pole surface (3) that have the sapwood thickness controlled to individual specifications (4) that have ground line area fully and evenly penetrated by creosote oil (5) that have appearance approved by exacting engineers.

"Long-Life" Process

By this method of full-length preservative treatment, the poles are first *machine-shaved* from tip of pole to ground line distance from extreme butt end, are made perfectly smooth with all knot projections eliminated, "turned" as though by a lathe, but finished with natural taper and contour of the timber. Sapwood thickness, after shaving, is provided to an average 3/8" thickness. The pole is then full-length preservative treated, *from tip to extreme end*, by immersion in specially designed tanks, in A. W. P. A. specification creosote oil, first for an eight-hour period in preservative maintained at 230 degree heat, then for a two-hour period in cold oil, followed by a one-hour period in hot oil maintained at 230 degree heat. This results in a pole thoroughly protected against any possible fungi attack sterilized from top to bottom—a dry pole, completely manufactured, that is RIGHT. Tests have proven that this processed treatment results in practically complete preservation of the 3/8" sapwood to total thickness—with a test absorption of 48 lbs. of preservative for each cubic foot of sapwood treated (the heartwood of cedar will not take treatment and, because of natural toxicity does not need it). For a sure thing in long service life this is the treatment—it is supreme.

BELL POLES
are obtained from
SELKIRK RANGE
High Altitude Cedar

Greater Strength — because of growth density
Greater Shock Resistance — because of compact fibre structure
Longer Life Expectancy — because of thinner sapwood in proportion to total cubical volume of naturally toxic heartwood
Perfect Pole Requisites—because they possess extraordinary stability, are light in weight, have low conductivity, permit spans of greater length, carry heavier loads, have very even taper, are straight, and possess unusual elasticity.

FULL LENGTH MACHINE SHAVED

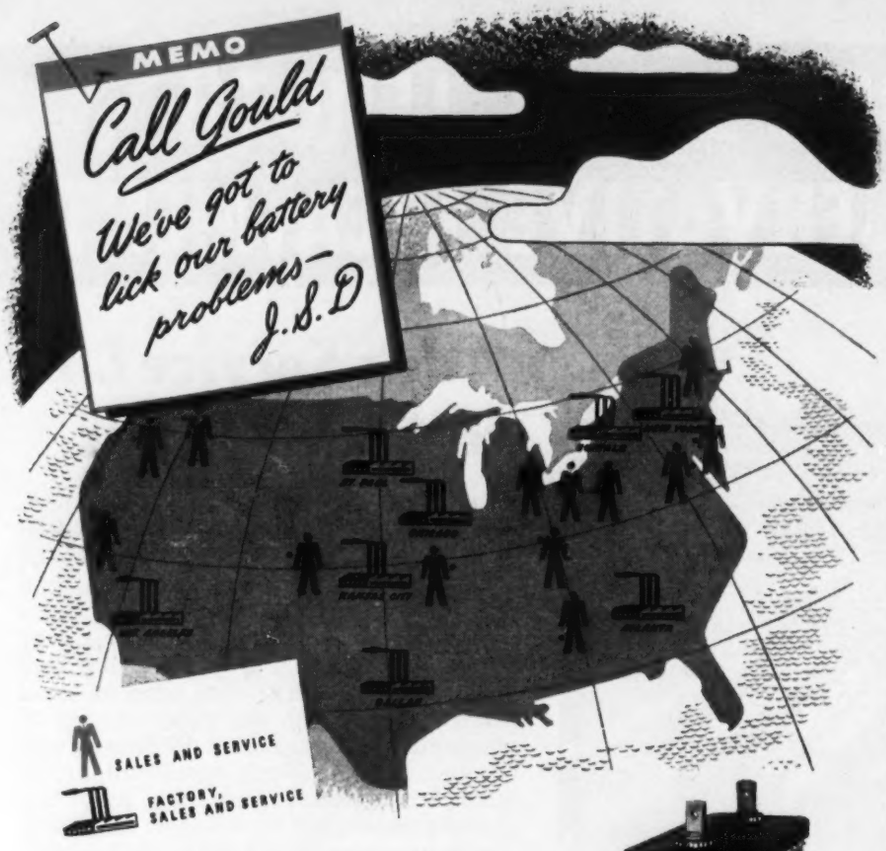
• Specify these new process BELL Poles for immediate and future economy.

BELL Poles all go through a specially designed incising machine where the ground line area is subjected to a fibre spreading process so that maximum penetration with No. 1 A. W. P. A. creosote oil is assured. This is but one of the important steps in the preparation of BELL Long-Life Cedar Poles. Section of pole above shows even and full sapwood penetration.

BELL LUMBER & POLE CO.
MINNEAPOLIS, MINNESOTA

BELL 1943 LBR. & POLE CO.

BELL WESTERN RED Cedar NORTHERN WHITE



GOULD DELIVERS

Unfailing Battery Service

• Use Gould service to solve your storage battery problems. Merely contact the nearest Gould office or factory—they are to be found in all principal cities—and a Gould field engineer will be on the job within a few hours.

This man is a battery expert. He can make an on-the-spot analysis of your battery problems and requirements. Behind him are the eight Gould factories, strategically located throughout the United States to assure quick deliveries of new installations, necessary repairs and maintenance.

Specify GOULD PLANTE...
The battery with antimony free positives for control and standby operations.

RATED CONSERVATIVELY
Goulds will equal or exceed in capacity any battery of comparable size and cell structure.

GOULD STORAGE BATTERY CORPORATION, DEPEW, NEW YORK

Builders of industrial batteries for every application. Sales and service offices in principal cities of the U.S.A.

Factories at Depew, N. Y., North Bergen, N. J., Dallas, Atlanta, Chicago, St. Paul, Leavenworth, Los Angeles

FOR EXCELLENCE IN STORAGE BATTERY PRODUCTION AT DEPEW PLANT

GOULD

Since 1898 THE BATTERY PICKED BY ENGINEERS

CLEANLINESS A PART OF BATTERY MAINTENANCE

One of a series of service suggestions for users of control batteries.

▶ Keep the top of your battery clean. Before adding water or taking out a vent cap for any purpose, brush off the top of the battery with a whisk-broom or rough cloth. It doesn't matter what kind of a job your battery has to do; it needs this attention constantly. Of course, if the battery is standing or moving in a locality which is exceptionally dirty, it is even more important to make sure there is no dirt on top of the battery before a vent plug is removed.

Foreign bodies resting around the battery, inside the top of a battery box or even from a higher tier of cells (in the case of a stationary installation) have been known to dislodge and fall into an open cell. When this occurs, it is often not noticed, and as a result no precautionary steps are taken to ascertain whether or not the foreign body was of such a nature as to harm the cell through mechanical or chemical means. Certain small sharp objects can cut separators, while iron and many other metals set up a third electrode, that reduces output and shortens life.

Brushing off the top of a battery before inspecting the level of electrolyte will serve two purposes. It will prevent the entrance of foreign bodies and will also minimize the effect of power loss through dust and moisture acting as a conductor between terminals.

Another good maintenance practice is to wipe the battery top about once a month with a weak solution of household ammonia . . . say one part ammonia to four of water. Then wipe off again with clean water. After this is done remove all connectors and burnish the terminal posts and other points of contact. Before reassembling give these parts a thin coating of vaseline or some other non-oxidizing grease.

We would like you to know the Gould men who will take care of your industrial storage battery requirements.

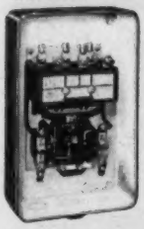
Headquartering in Chicago, and serving a number of Mid-west States, are E. Kopper, Sales Manager, W. D. Thomas and M. E. McCall. Their address is 400 West Madison Street, Chicago, Ill.

Reaching somewhat farther afield you will find M. Brackney at 2014 Market St., Denver, Colo., and A. B. Ashton at E. 1200 First National Bank Building, St. Paul, Minn.

[Advertisement]

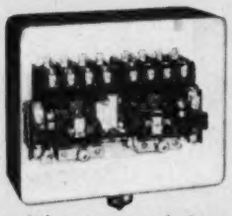
These 3 Types of trouble-free starters will solve most of your motor control problems

BULLETIN 709 ACROSS-THE-LINE STARTER



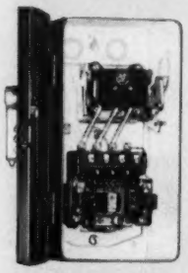
The simplest starter for alternating-current motors . . . never needs any maintenance. Has only one moving part. No pins, pivots, or hinges to stick. No flexible jumpers to break. Silver alloy, double break contacts never need cleaning or filing. This is the starter you install and can forget. It's good for millions of trouble-free operations. For complete details, write today for Bulletin 709.

BULLETIN 705 REVERSING SWITCH



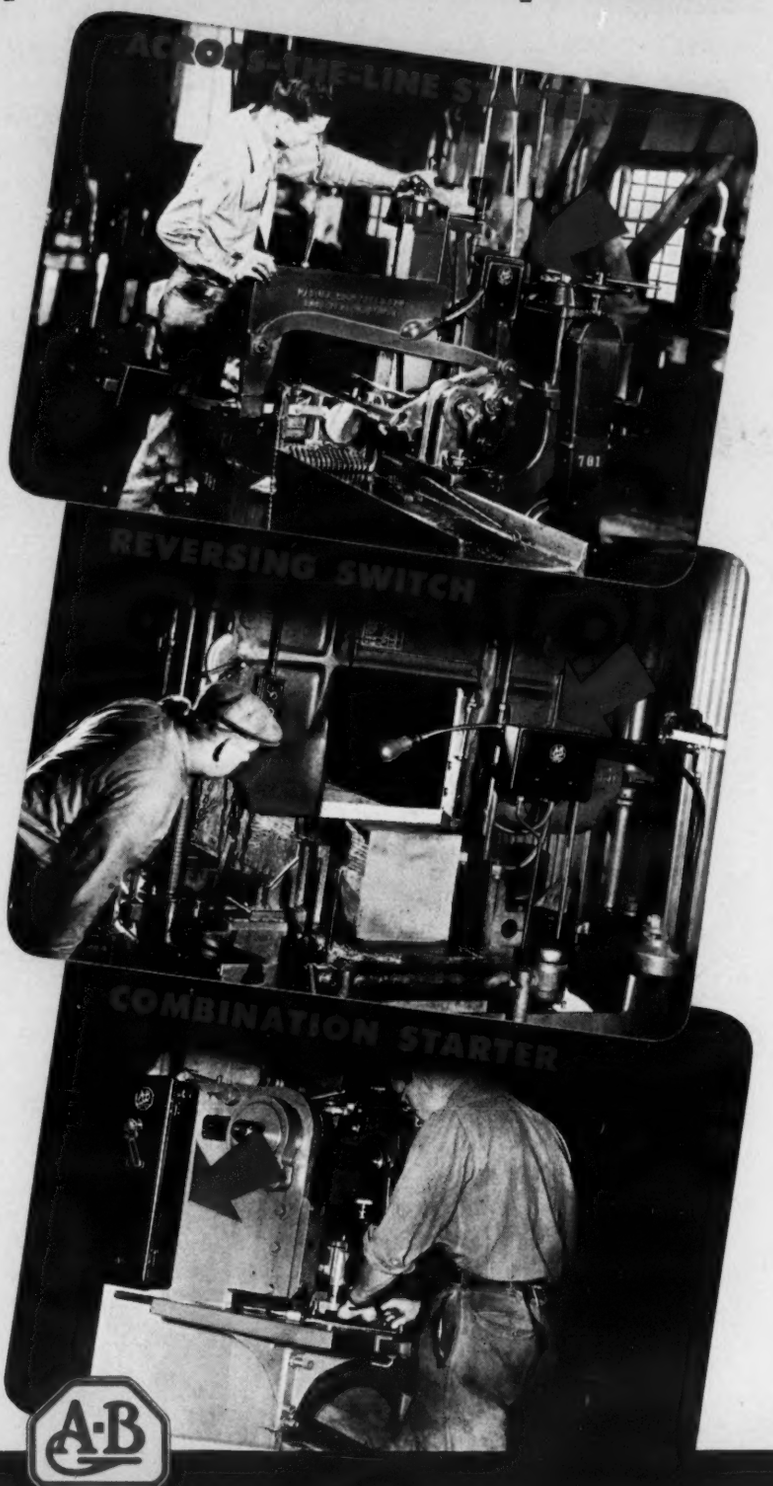
Two Bulletin 709 starters, mechanically interlocked so both contactors cannot be closed at the same time, form an Allen-Bradley automatic reversing switch. They have the same simple construction and trouble-free life. These switches open and close instantaneously without perceptible variation in operating time. Write today for Bulletin 705 for details.

BULLETIN 712 COMBINATION STARTER



These combination starters, consisting of a solenoid starter and disconnect unit in one cabinet, reduce installation time, save space, save critical materials, make a neater installation, and provide greater safety. Both units have patented double break, silver alloy contacts assuring freedom from maintenance. Available in enclosures for every class of service. Write today for Bulletin 712.

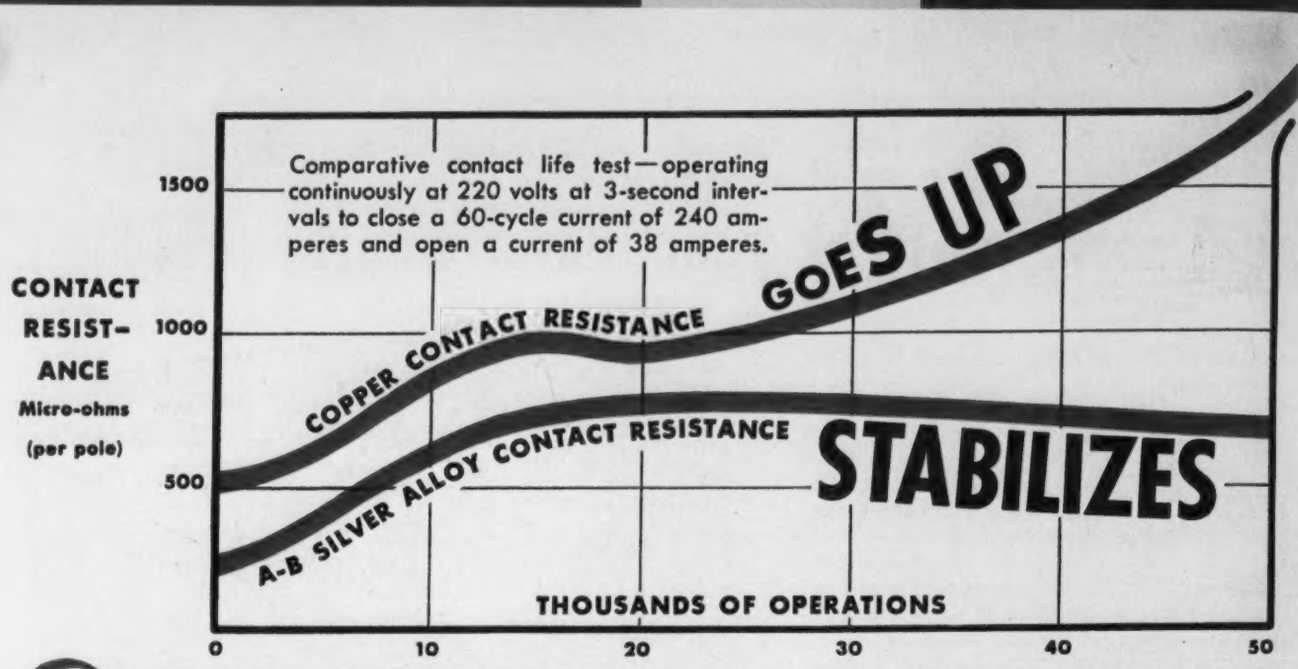
Bulletin 800 Types 2SA and 3SA are two popular A-B push button stations. More than 800 varieties of push buttons are available to meet any operating requirement. They are neat, compact, rugged, and trouble-free, too.



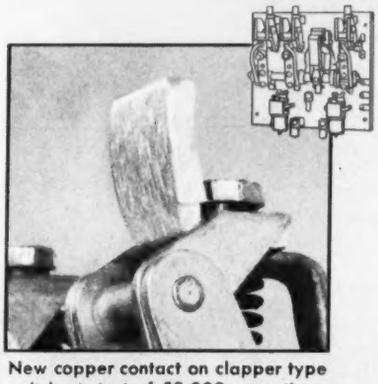
A-B Quality

ALLEN-BRADLEY

SOLENOID MOTOR CONTROLS FOR ALL INDUSTRIES



That's Why A-B SILVER ALLOY CONTACTS OUT-PERFORM COPPER CONTACTS



New copper contact on clapper type switch at start of 50,000 operations.

Same contact after test. Badly pitted and oxidized—must be replaced.

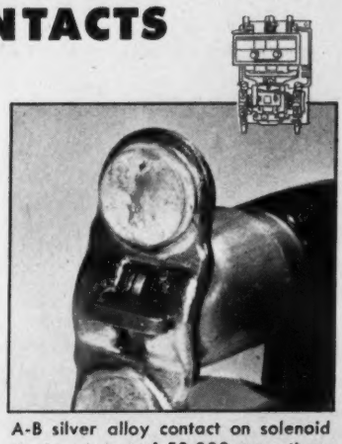
There's a big difference between copper and silver alloy contacts. It shows up quickly . . . in less than 50,000 operations . . . as revealed in the above test.

Copper contacts become coated with a high-resistance oxide that causes them to overheat. Heat . . . then more oxide . . . then more resistance . . . still more oxide . . . still more resistance . . . then failure and shutdown for replacement.

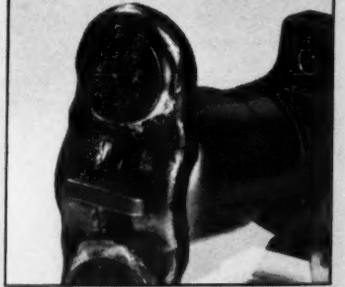
A-B silver alloy contacts also become coated with oxide . . . but silver oxide is just as good a conductor as the original metal. There is no heating . . . no increase in resistance . . . no matter how long A-B silver alloy contacts remain closed, they never fail. They never need filing, cleaning, or dressing. They are completely maintenance-free.

Every test . . . in laboratory or in service . . . verifies the superior performance of silver alloy contacts. Specify Allen-Bradley solenoid starters—all are equipped with patented A-B silver alloy contacts.

ALLEN-BRADLEY COMPANY
1316 S. Second St., Milwaukee, Wis.



A-B silver alloy contact on solenoid starter at start of 50,000 operations.



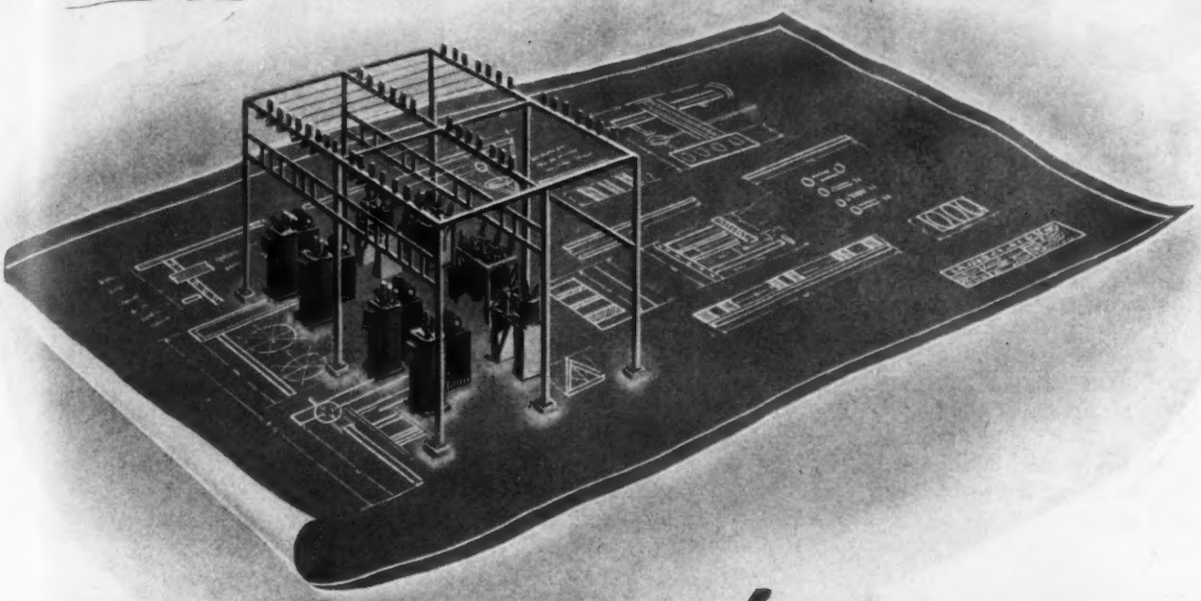
Same contact at the end of the test still in perfect operating condition.

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

For *TODAY'S* needs...

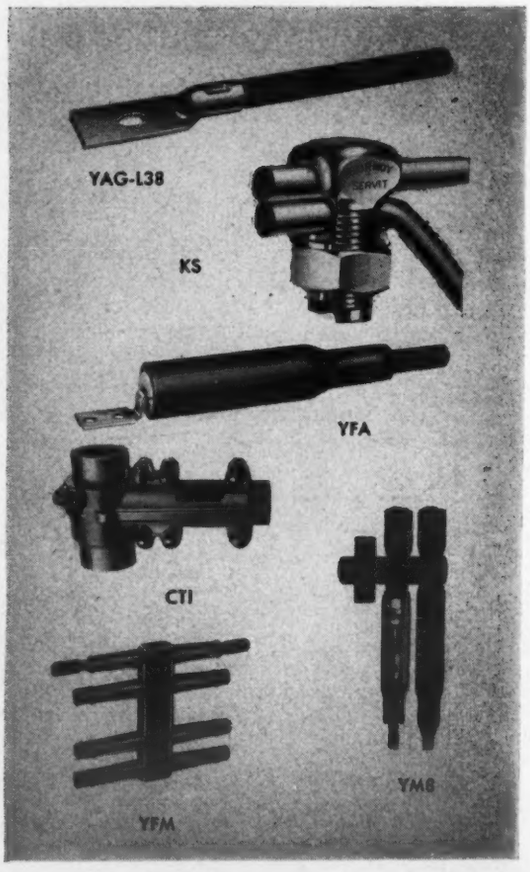


and *TOMORROW'S* Planning!

The connectors so familiar to you *still* are being produced in ever increasing numbers for our fighting forces on land, on sea, and in the air.

Burndy Moles, Hyline connectors, bus connectors and many another Burndy connector designed originally for utility use, now cover the seven seas in naval and merchant ships and at their bases. Burndy Hylugs, Hylinks and Limiters, are used on all types of fighting aircraft. And the versatile and ever-popular Servit, now serves our armed forces in countless ways.

But while production has been hummin' here at Burndy, engineering development has never ceased. From meeting and solving our wartime needs have come — and will come — many connector developments which will influence tomorrow's peacetime planning — and keep Burndy still farther in the lead as "Connector headquarters" for all utility needs.



Burndy

ELECTRICAL CONNECTORS

BURNDY ENGINEERING CO., INC., 107 EASTERN BOULEVARD, NEW YORK

VARNISHED CAMBRIC · RUBBER POWER CABLES · BUILDING WIRE · RADIO WIRES · SIGNAL CABLES · FLEXIBLE CORDS · LEADENCASED AND ARMORED CABLES

CRESFLEX NON-METALLIC SHEATHED CABLE · SERVICE ENTRANCE CABLE · MAGNET WIRE · BARE WIRE

Some of the

CRESCENT

ELECTRIC WIRES AND CABLES

That Are Meeting To-day's Special Needs

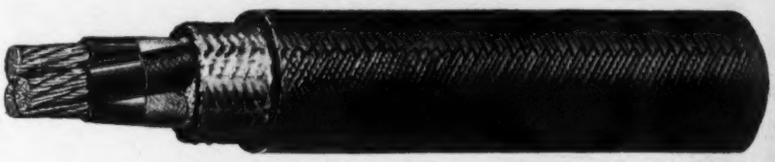
For war housing, industrial wiring and interior wiring of all kinds.

"CRESFLEX" Non-Metallic Sheathed Cable

Extensively used in shipyards, and for the manufacture of tanks, guns and planes.

Welding Cable

For portable power leads to drills, tools, welding and construction machinery.

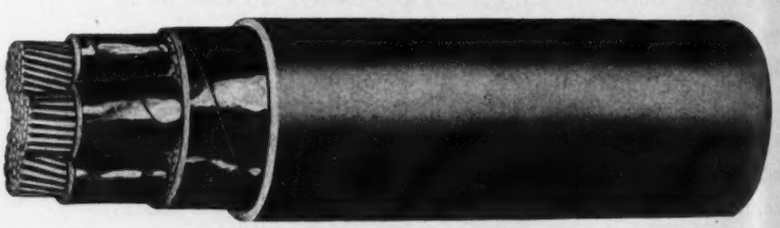


"PERMACORD" Heavy Duty Portable Cable

For electric power and control circuits aboard ship.

SHIPBOARD CABLE

For general industrial power wiring. Widely used because no rubber required in construction, and can carry larger currents for same size copper conductors.



Varnished Cambric Power Cable

CRESCENT INSULATED WIRE & CABLE CO.

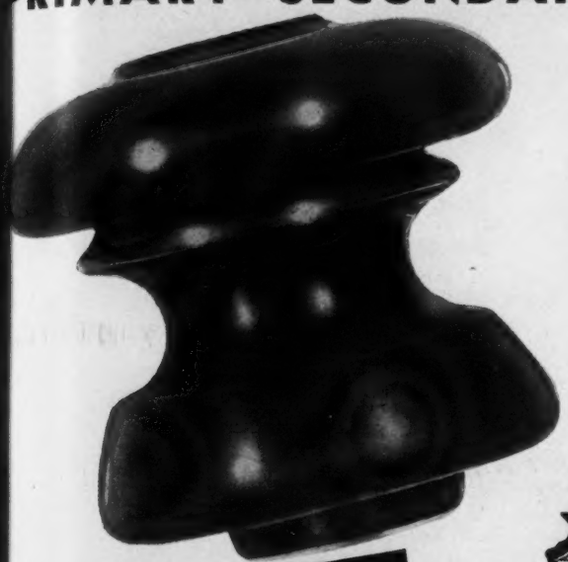
CRESCENT
WIRE and CABLE

Factory: TRENTON, N. J.—*Stocks in Principal Cities*

CRESCENT ENDURITE SUPER-AGING INSULATION · WEATHER-PROOF WIRE

ILLINOIS

PRIMARY··SECONDARY AND SHACKLE SPOOL INSULATORS . . .



The need for dependable mechanical and electrical strength in Insulators of these types is adequately met by our Wet Process Porcelain. Plus this are the Illinois standards of manufacture that insure exact dimensions and uniformity. Our Wet Process Spool Insulators are made of the same materials and with the same careful workmanship as used in our high tension Insulators. We are equipped to manufacture any special shape desired.

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILLINOIS

HIGH DIELECTRIC STRENGTH

HIGH MECHANICAL STRENGTH

EXACT DIMENSIONS AND UNIFORMITY

POWER'S CONTRIBUTION TO LIBERTY

ENGAGED in the most colossal shipbuilding program of all time, America is delivering more than 100 cargo ships each month. To achieve this unprecedented construction rate, shipyards are working round the clock. Turning night into day in this 24-hour-a-day operation is a vital wartime contribution of electric light and power.

Producing the constantly increasing power needs for shipbuilding and other essential industries is placing heavy demands on turbo generating equipment. To assure maximum output, power plants everywhere are lubricating their steam turbines with *Texaco Regal Oils.*

Texaco Regal Oils rapidly free themselves from air and water, and highly resist oxidation and emulsification. They keep lubricating systems free from harmful gum and sludge deposits, assuring normal bearing temperatures . . . and governors instantly responsive to every load-change.

So effective have Texaco Lubricants proved that they are definitely preferred in many other important fields, a few of which are listed in the panel.

A Texaco Lubrication Engineer will gladly cooperate in the selection of the most suitable lubricants for your equipment. Just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

★ More stationary Diesel horsepower the U. S. is lubricated with Texaco th with any other brand.

★ More Diesel horsepower on stre lined trains in the U. S. is lubricated w Texaco than with all other brands co bined.

★ More locomotives and railroad cars the U. S. are lubricated with Texaco th with any other brand.

★ More revenue airline miles in the U. are flown with Texaco than with any oth brand.

★ More buses, more bus lines and mo bus-miles are lubricated and fueled w Texaco than with any other brand.

TEXACO

TEXACO Regal Oils

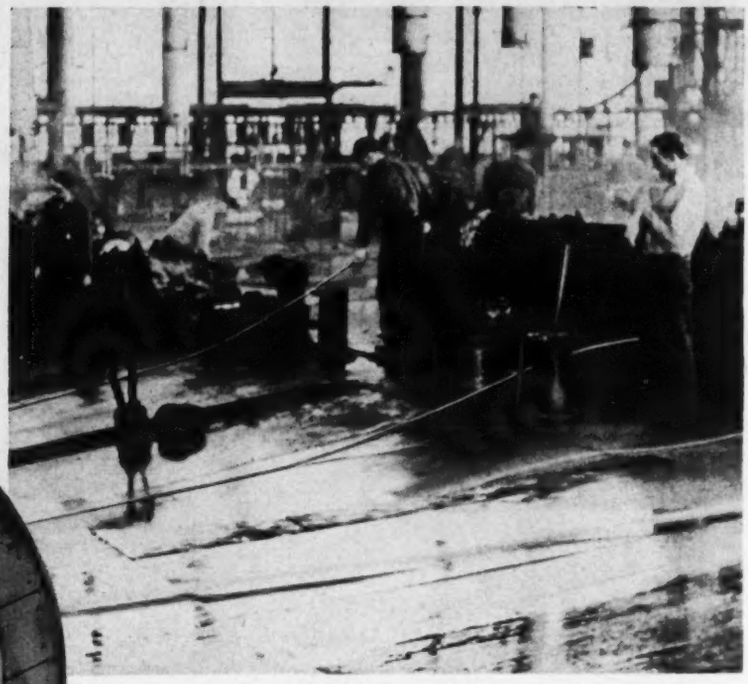
FOR ALL TURBINES

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS ★ HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPT

Every Stage in Wire-Making

is Controlled by

ROME CABLE



Maintaining our own rolling mills, we start fabrication with the copper bar.

All Rome Cable products are manufactured in our own mills to exacting standards under strict engineering supervision. Every process is carefully controlled and no finished products are released without the approval of our Inspection Department.

REASONS FOR ROME CABLE QUALITY

PRODUCTS

- HOT ROLLED COPPER RODS
- BARE AND TINNED COPPER WIRE (In rounds, flats and squares)
- BARE AND TINNED STRAND
- URC WEATHERPROOF WIRE
- COTTON, PAPER AND ASBESTOS MAGNET WIRE (In rounds, flats and squares)
- RUBBER INSULATED WIRES AND CORDS
- SYNTHETIC INSULATED WIRES AND CABLES (Thermoplastic—Neoprene)
- LEAD COVERED CABLES
- SERVICE ENTRANCE CABLES

★★★

"Rome 60" Heavy Duty Cords and Cables

ROME
CABLE CORPORATION
ROME, N. Y.

SALES OFFICES

NEW YORK
60 E. 42nd. St.

CHICAGO
208 S. Jefferson St.

LOS ANGELES
327 E. 4th. St.

PITTSBURGH
2537 Koppers Bldg.

CLEVELAND
817 Citizens Bldg.

PHILADELPHIA
1803 Liberty Trust Bldg.

MARSHFIELD HILLS, MASS.

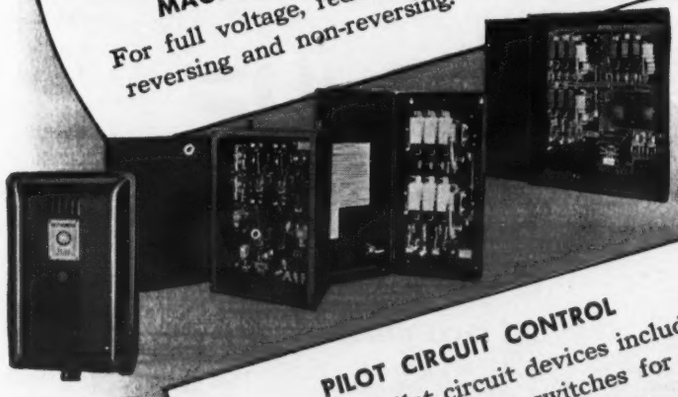
RICHMOND, VA.
2027 South Blvd.

WASHINGTON, D. C.
Room 410, Bond Bldg.

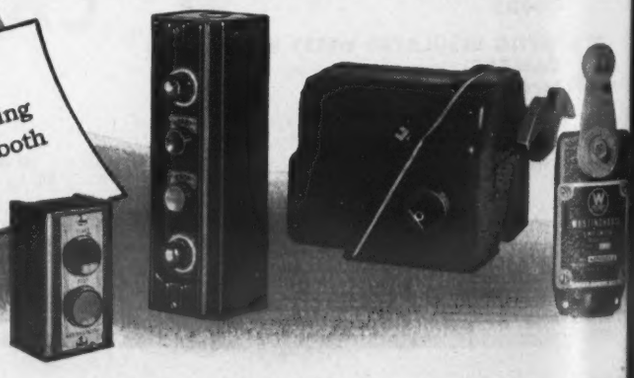
and Motor Control shall be designed to:
1. PROVIDE THE GREATEST RELIABILITY FOR TODAY'S HIGH SPEED WAR PRODUCTION...
that's Westinghouse

MANUAL MOTOR CONTROL
For full voltage, reduced voltage, or step starting, speed regulating, reversing and non-reversing.

MAGNETIC MOTOR STARTERS
For full voltage, reduced voltage, step, reversing and non-reversing.



PILOT CIRCUIT CONTROL
All types of Pilot circuit devices including push buttons and limit switches for both standard and heavy-duty service.



Design features like the Westinghouse "De-ion" principle of arc extinction are certainly a common-sense "must". And today's production goals need the kind of protection that the Bi-metal overload relay can give. The Westinghouse line of a-c and d-c motor controls is complete for motor types that meet requirements of a wide variety of applications.

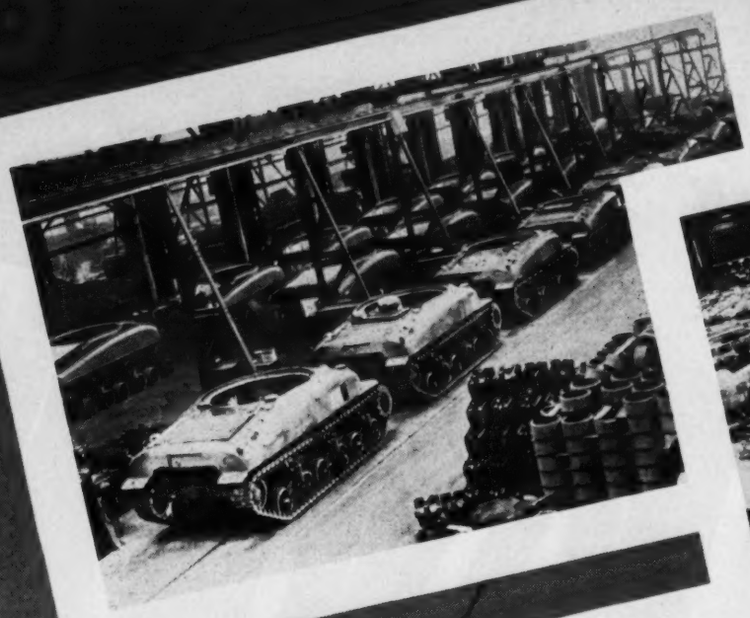
So when you need motor controls—write "Westinghouse" in the specifications. Then get your Westinghouse representative on the phone. He'll help you all the way from application to installation. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

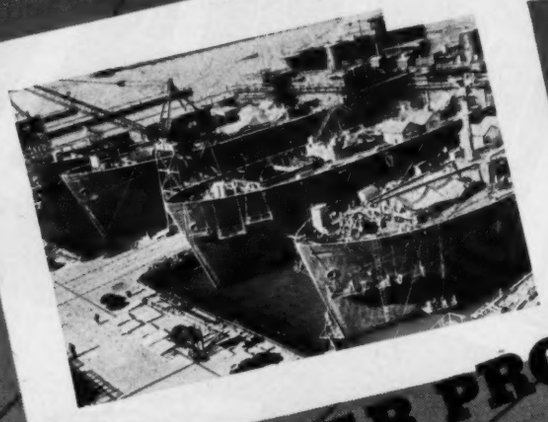
J-21270

Westinghouse

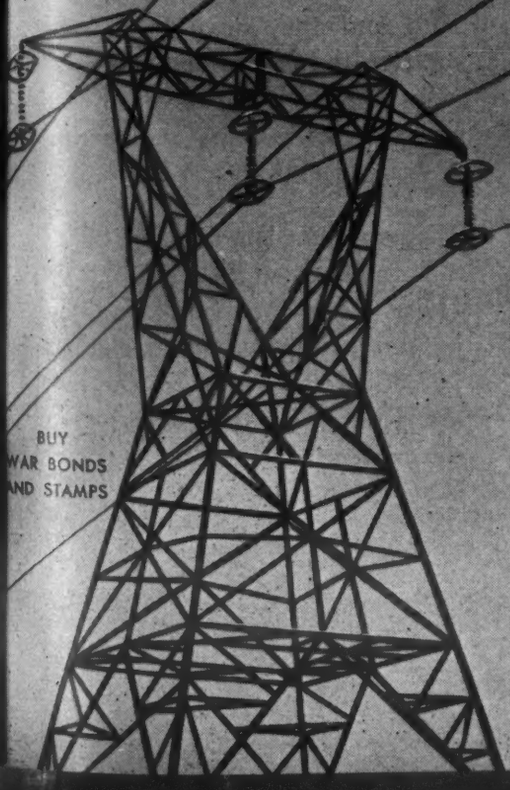
PLANTS IN 25 CITIES... OFFICES EVERYWHERE

MOTORS AND CONTROLS





LIFE LINE OF WAR PRODUCTION



Through transmission lines flows the current that makes American war production possible. Supporting these Arteries of Victory are Blaw-Knox Transmission Towers . . . proved by their performance to be engineered right, built right for long-lasting, low-maintenance service.

BUY WAR BONDS AND STAMPS

BLAW-KNOX
TRANSMISSION TOWERS

Blaw-Knox Division of Blaw-Knox Company

Farmers Bank Building, Pittsburgh, Pa.

New York • Chicago • Philadelphia • Birmingham • Washington

"Three E"

HIGH VOLTAGE AIR BREAK SWITCHES

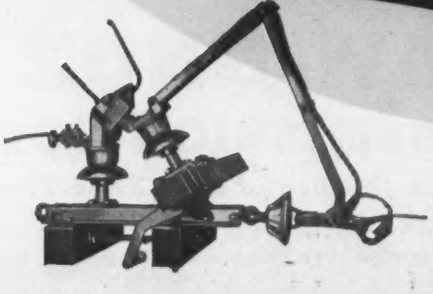
From GIANT

Single pole of 230,000 volt "8400" type switch. One of the large number built for Boulder Dam.

Whether it is an air break switch for operation on 230,000 volts at Boulder Dam or on 4,000 volt distribution lines, either urban or rural, "THREE E" has it.

Design of all "THREE E" air break switches has been fundamentally sound from the beginning and they have been kept modern to meet changing conditions. Their use conserves critical materials and keeps engineering standards high.

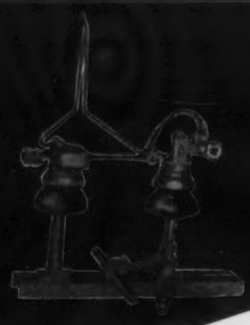
The complete line of "THREE E" air break switches is shown. There is one for every condition of service up to and including 287,000 volts. Write for the bulletins indicated after each switch description.



"8900-L" type tilting insulator, vertical break, two insulators per pole. Built for all voltages 7500 to 34,500. Ask for Bulletin No. 322.

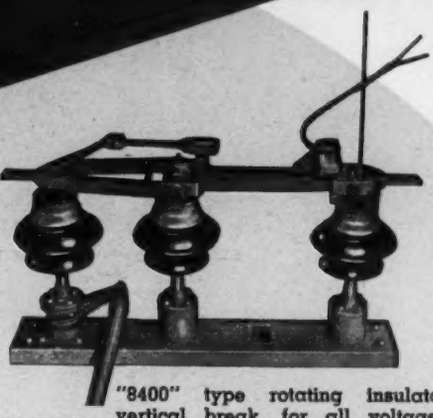
ELECTRICAL ENGINEERS EQUIPMENT CO. THREE E MELROSE PARK, ILL. U.S.A. THE MARK OF QUALITY

MIDGET

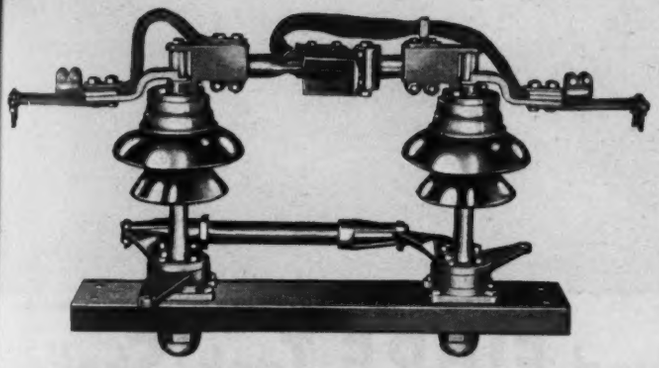


"6600-SU" type rotating insulator single side break, for urban and rural distribution lines. Built for 7500 and 15,000 volts. Ask for Bulletin No. 330.

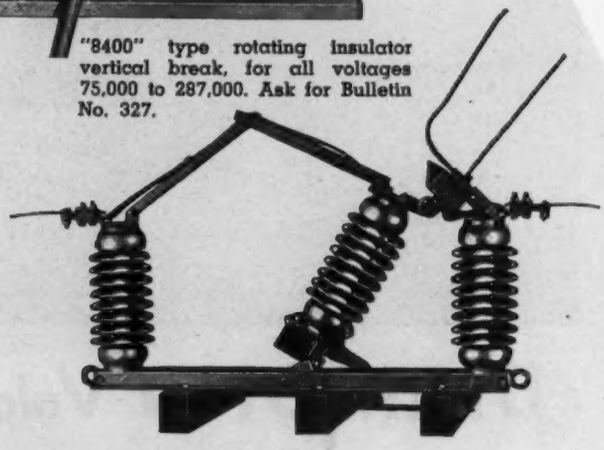
Any "THREE E" air break switch can be motor operated as well as manually operated. See Bulletin No. 326.



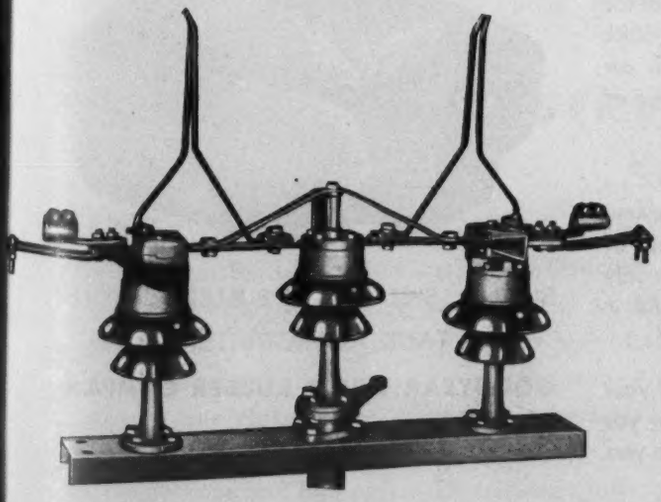
"8400" type rotating insulator vertical break, for all voltages 75,000 to 287,000. Ask for Bulletin No. 327.



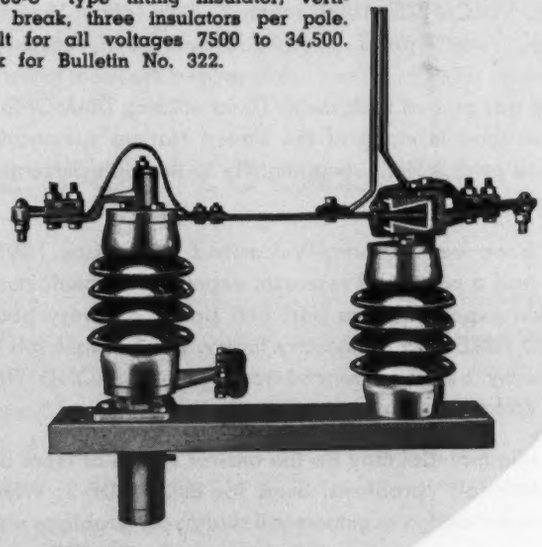
"6300" type air break switch. Desirable when close phase spacing is necessary.



"8900-U" type tilting insulator, vertical break, three insulators per pole. Built for all voltages 7500 to 34,500. Ask for Bulletin No. 322.



"6200" type center rotating insulator, double side break. Built for all voltages 7500 to 161,000. Ask for Bulletin No. 325.

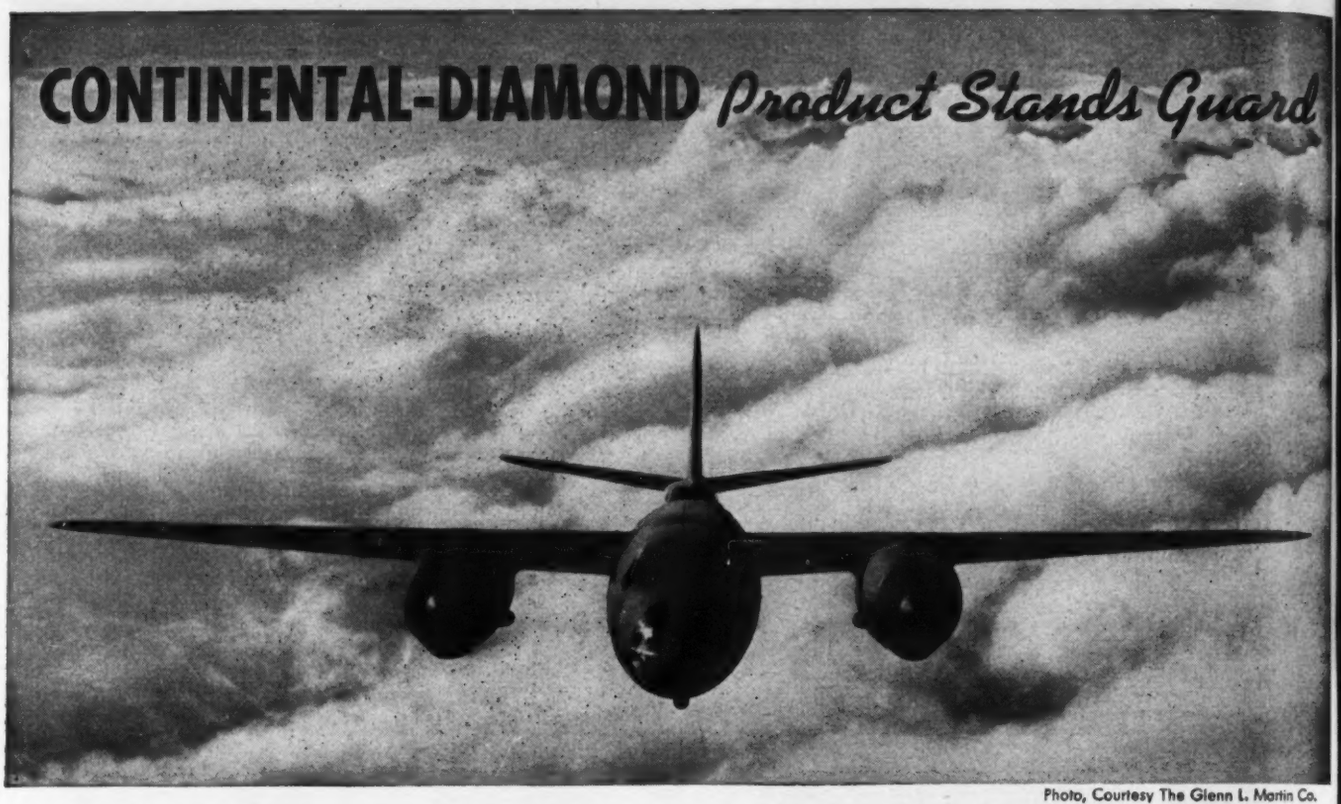


"6600-U" type single rotating insulator side break. Built for all voltages 7500 to 161,000. Ask for Bulletin No. 325.

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK ILLINOIS

TOKYO....BERLIN....ROME

Leaking Gas Tanks Might Mean Disaster...so a



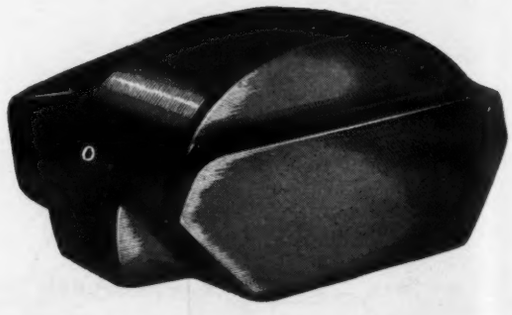
Photo, Courtesy The Glenn L. Martin Co.

DIAMOND *Vulcanized* FIBRE *Tank Shells*

DIAMOND VULCANIZED FIBRE, tough . . . light (about ½ weight of aluminum) . . . shatterproof . . . easily formed, glued, fabricated . . . unaffected by oil or gasoline . . . has proved the ideal material for leakproof gas and oil tank shells. Tanks utilizing DIAMOND FIBRE have been used in many of the United Nations spectacular air battles and raids, contributing mightily to the high percentage of planes returning safely.

C-D has been manufacturing Vulcanized FIBRE since 1895 . . . almost a half a century of research, experiment, manufacture and application experience are part and parcel of every pound of DIAMOND FIBRE used by industry today. This gas tank job is only one of many being performed today by DIAMOND FIBRE in the War Effort.

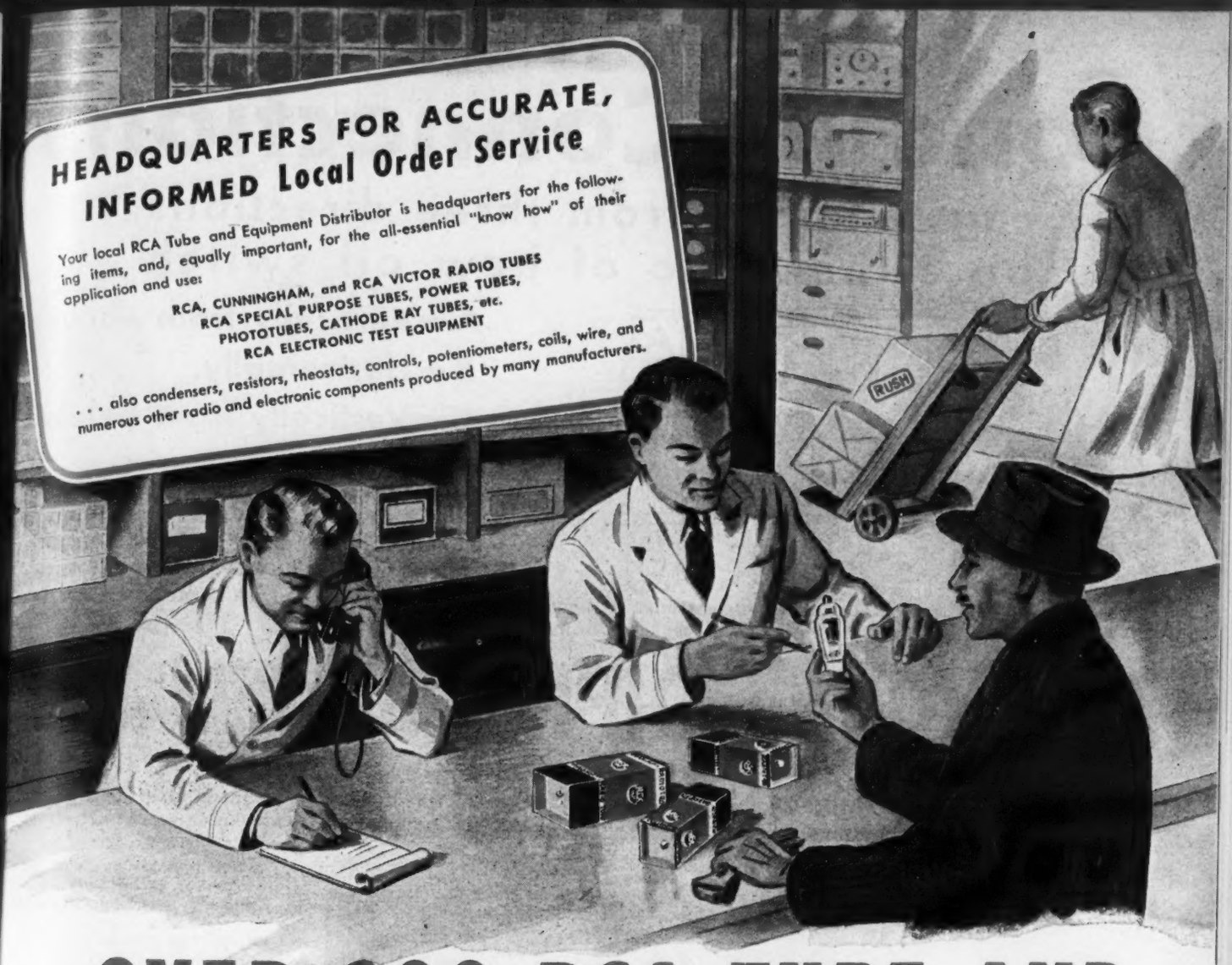
This versatile material may be the answer to one or more of your "What Material?" problems. Send for Bulletin DF-3. When you are ready, our design engineers will study your problems with you.



RUBBER SHEATHED, BULLET SEALING FUEL TANK AS PRODUCED BY THE **GOODYEAR TIRE & RUBBER COMPANY**

Continental-Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE


HEADQUARTERS FOR ACCURATE, INFORMED Local Order Service
Your local RCA Tube and Equipment Distributor is headquarters for the following items, and, equally important, for the all-essential "know how" of their application and use:
RCA, CUNNINGHAM, and RCA VICTOR RADIO TUBES
RCA SPECIAL PURPOSE TUBES, POWER TUBES,
PHOTOTUBES, CATHODE RAY TUBES, etc.
RCA ELECTRONIC TEST EQUIPMENT
. . . also condensers, resistors, rheostats, controls, potentiometers, coils, wire, and numerous other radio and electronic components produced by many manufacturers.
RUSH

OVER 300 RCA TUBE AND EQUIPMENT DISTRIBUTORS

. . . TO SERVE YOU LOCALLY!

WHETHER your need is for one electronic item or a dozen, your RCA Tube and Equipment Distributor is geared to help you select it and get it as rapidly as possible! The fact that there are over 300 of these distributors throughout the nation means that there is one close by—ready to deliver personalized, 'round-the-corner service.

RCA Tube and Equipment Distributors not only afford a convenient, 'round-the-corner source of supply, but back their merchandise with a technical knowledge that has proved invaluable.

If you do not already know the name of your nearest RCA Distributor, write or wire us today.

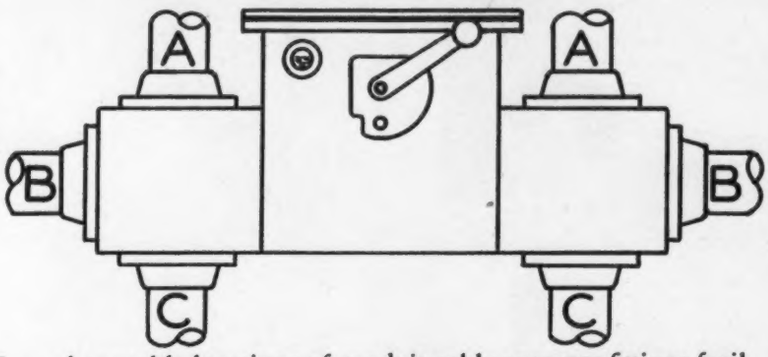
Put his services to work in solving your electronic equipment buying problems. Take advantage of the large and varied stocks he normally maintains. Let him serve as your specialized "expediter." Ask him for the technical suggestions he is so well qualified to give!

RCA MANUFACTURING CO., INC., Camden, N.J.

AN ADVERTISEMENT OF THE RCA TUBE AND EQUIPMENT DIVISION IN THE INTEREST OF GREATER SERVICE AND EFFICIENCY IN PRIORITY-COVERED WAR MATERIALS BUYING

Conduit Connections

can be made from three directions on either side of new oil switch



Interchangeable locations of conduit-cable entrance fittings facilitate installation of the switch under variable conditions.

A—Vertically from above.
B—Horizontally.
C—Vertically from below.

Cables are terminated in compartments having three openings on which the conduit—cable entrance fittings can be interchangeably located. By using an extra entrance fitting two circuits (straight through run) can be terminated in one compartment.

G & W Type "DIPK" SINGLE THROW OIL SWITCH

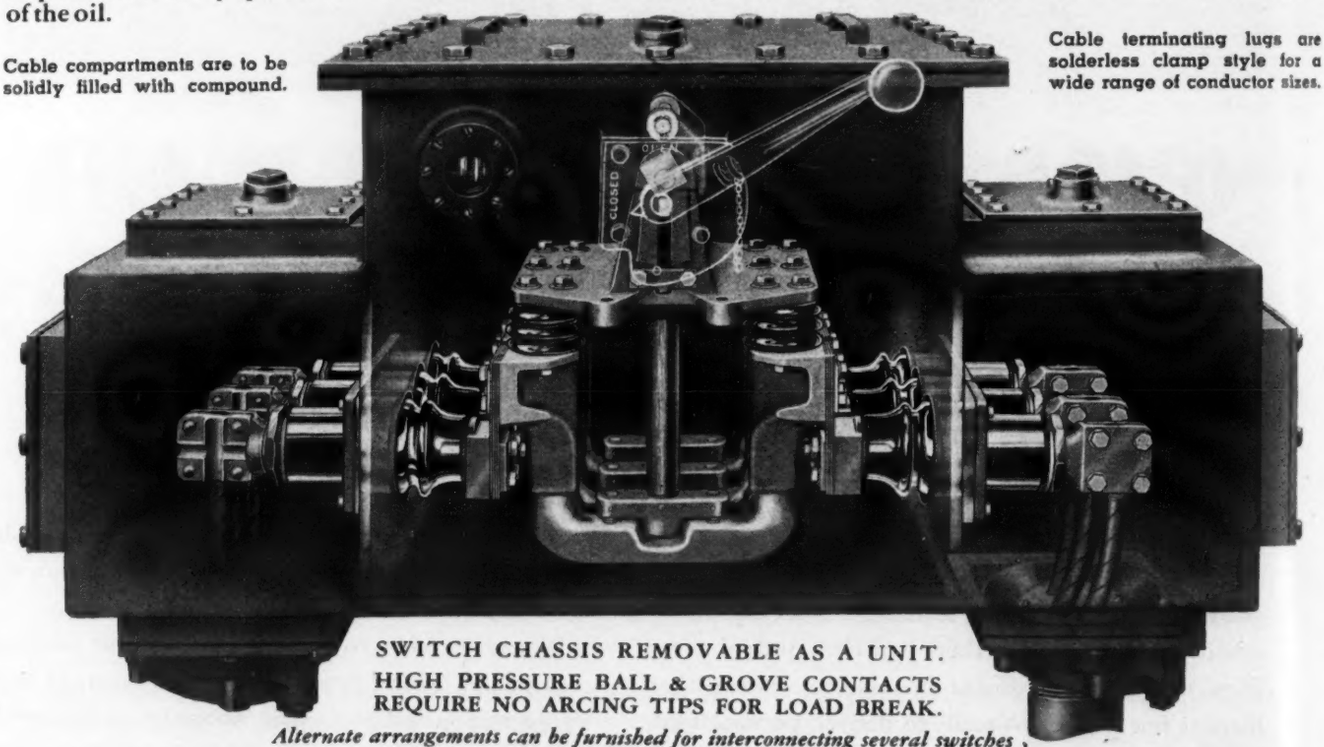
3 pole—5000 volts—600 amps.

FOR CLASS 1, GROUP D, HAZARDOUS LOCATIONS

G & W Type "DIPK" oil switches were specially designed for use in oil refineries and chemical plants to meet the requirements of equipment for hazardous locations. The live parts within the oil switch are 6 inches below the level of the oil.

Cable compartments are to be solidly filled with compound.

Cable terminating lugs are solderless clamp style for a wide range of conductor sizes.



SWITCH CHASSIS REMOVABLE AS A UNIT.
HIGH PRESSURE BALL & GROVE CONTACTS REQUIRE NO ARCING TIPS FOR LOAD BREAK.

Alternate arrangements can be furnished for interconnecting several switches by converting cable compartment to a section of a compound filled bus run.

Send for Bulletin No. 543

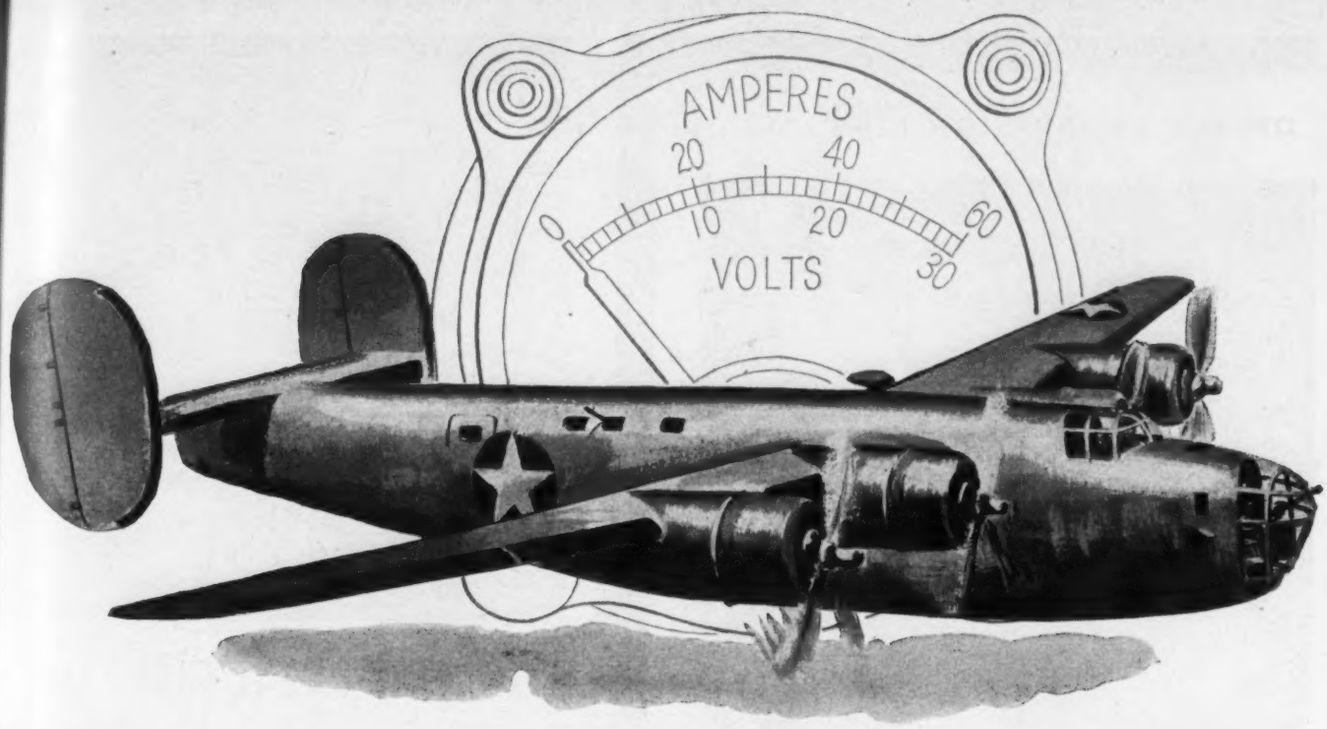
G&W ELECTRIC SPECIALTY CO.

7780 Dante Avenue **Chicago, Illinois, U.S.A.**

Also made in Canada by Powerlite Devices, Ltd., Toronto

G&W ELECTRIC CABLE DEVICES

POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNECTS



HELPING "DEALERS IN DEATH" *save lives*

When the accuracy of instruments means Victory . . . or death . . . instruments must be precision-built for battle duty. Today, in ships . . . planes . . . tanks, the accurate, positive calibration of Westinghouse instruments is guiding our warriors into battle . . . and out . . . in spite of searing heat, congealing cold or shock of bursting shells.

THE PIVOT PROTECTS THE ACCURACY

One reason for this dependable accuracy is the tough hard pivots used in all Westinghouse instruments. Made by a special process, they resist blunting . . . protect careful calibrations. Every manufacturing step is carefully controlled.

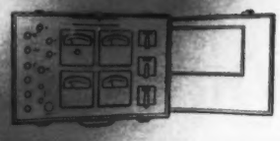
Honing pressure is precisely regulated . . . pivots are tumbled to relieve stress and set grain structure . . . a 500-to-1 contour enlargement of each point is carefully inspected . . . photomicroscopic studies and hardness tests check uniformity.

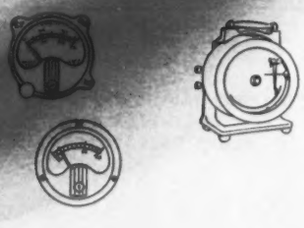
Casting "shadows" of Victories to come . . . these details are of prime importance today. For, on them, human lives depend. The skills and abilities we are now directing to war work, will, in peacetime, enable us to supply you with electrical instruments finer than ever before. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pennsylvania, Department 7-N. J-40339

THIS IS A WAR OF INSTRUMENTS

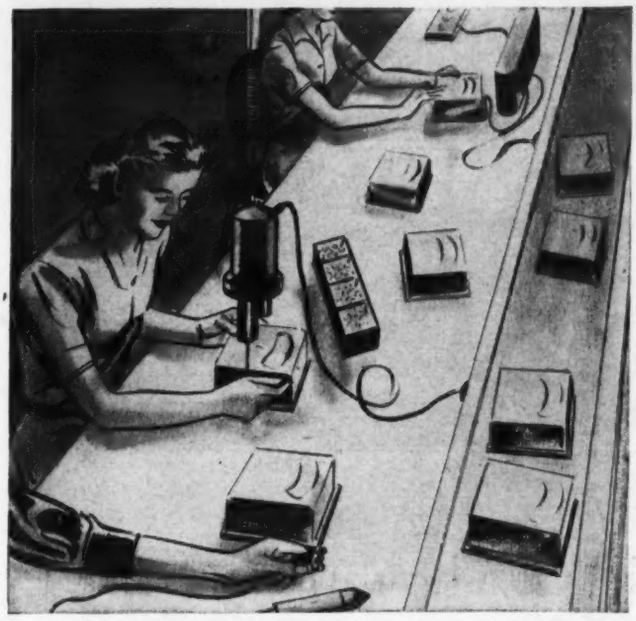
Westinghouse INSTRUMENTS

PLANTS IN 25 CITIES... OFFICES EVERYWHERE



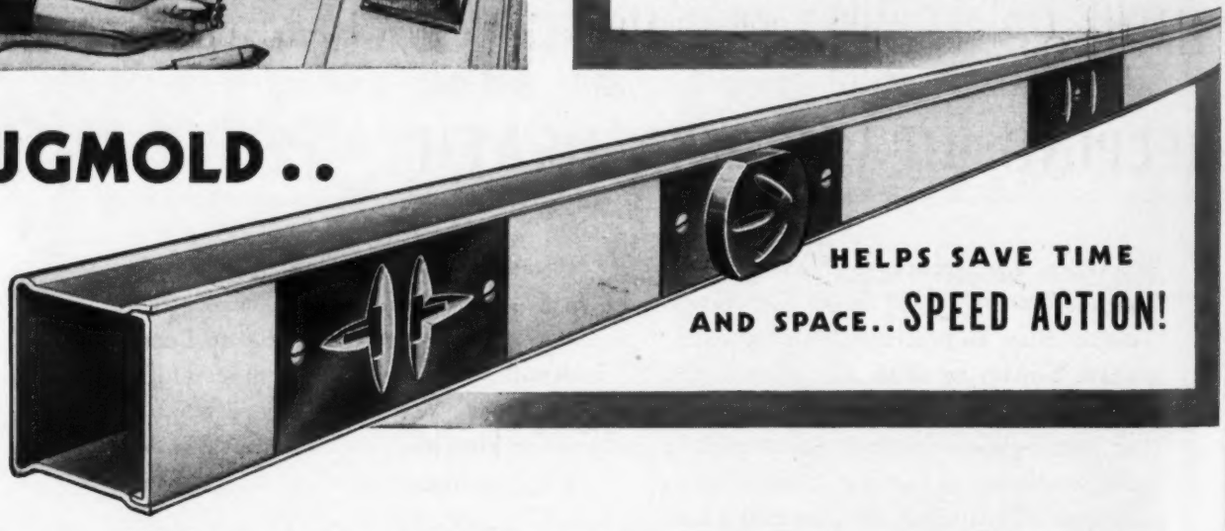


ON THE PRODUCTION LINE . . .



YES . . . AND ON THE **FRONT LINE**

PLUGMOLD . .



HELPS SAVE TIME AND SPACE . . SPEED ACTION!

The GIRL in our picture doesn't have to duck down underneath the bench or disturb her neighbor to reach the "nearest" electrical outlet for her drill. She merely plugs into the Plugmold outlet right at her station. And if she wants to connect the soldering iron or a test meter at the same time, another Plugmold outlet is right there, too. No need to tell you how that saves lost motion, cuts work time and fatigue, ups production substantially.

And the BOY in the picture, in a mobile shop unit, out on the *front* line, finds Plugmold right there behind the benches to help him save time and speed work, too.

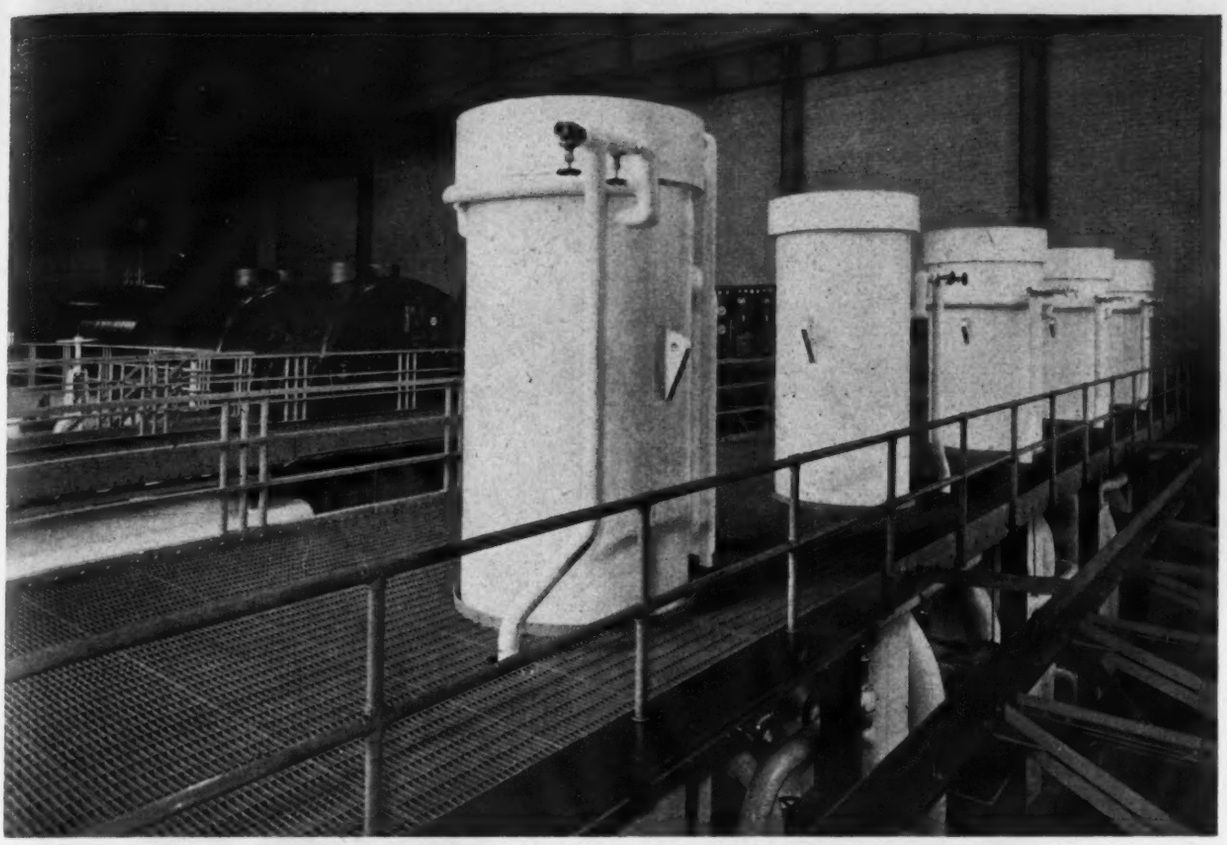
Better get to know this unique convenience wiring system that's complete with fittings for 3-wire industrial applications . . . a helping hand in production today that will be increasingly important in every factory, store, public building and home tomorrow. Listed by U. L.; conforms to Federal Specification W-R-32. The Wiremold Company, Hartford, Conn.

WIREMOLD CAN HELP YOU PRODUCE FOR *WAR* AND PLAN FOR *PEACE!*

"HELPING HAND" LITERATURE FOR ENGINEERS AND PLANT OPERATORS

- ☐ Bulletin, "Wiremold Industrial System-Wiring Speeds War Production".
- ☐ Engineering Data Sheets, Plugmold Multi-Outlet Wiring Systems.
- ☐ Wiremold Catalog and Wiring Guide.
- ☐ Engineering Data Sheets No. "3000" System Wiring for Industrial plants.
- ☐ "Pancake" Wiremold Overfloor Wiring System for Office and factory.

CHECK and return with your name and address



The 100,000 kw extension of a prominent public utility includes five feedwater heaters.

FEEDWATER HEATERS

Five Foster Wheeler vertical extraction heaters doing wartime duty in a large central station preheating more than 1,000,000 lb. feedwater per hour from 80 deg. F. to over 440 deg. F.

Four of these units, designed for operating pressures to 2150 lb. per square inch, are equipped with Lockhead closures whose construction requires only moderate sized bolting. The gasket load is entirely segregated from pressure load on the head. This factor makes for ease of maintenance and uninterrupted service, so important in these critical days.

Feedwater heaters by Foster Wheeler for all capacities and pressures up to 3,200 lb. pressure have been in service for many years.

FOSTER WHEELER CORP., 165 Broadway, New York, N. Y.

FOSTER FW WHEELER

It's no good if he doesn't know how to use it!

• It's an odds-on bet . . . sometime soon one of your men will face a fire, armed with one of your extinguishers.

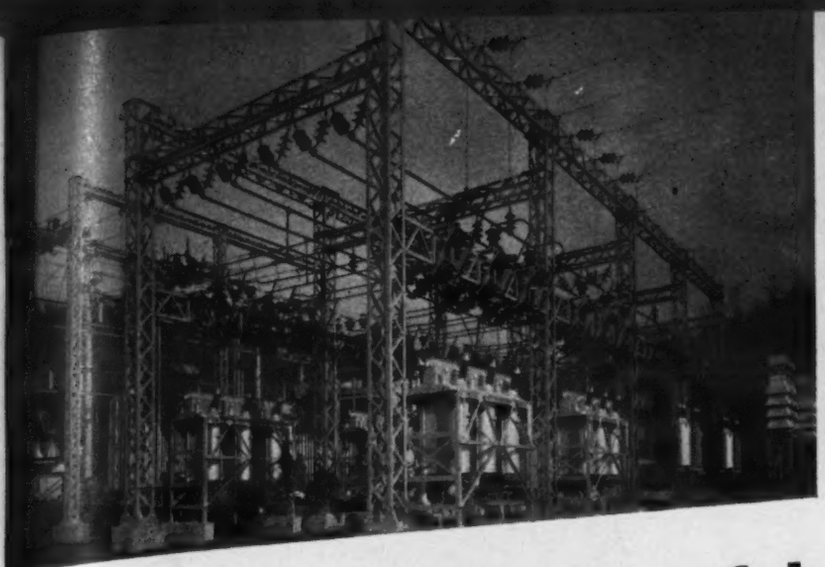
Will he know what to do? Will this man in your plant know what kinds of fire this extinguisher should be used against? Does he know how to make it work?

There is one sure way to control blazes in your plant—fast and sure-handedly. Teach key men how to handle fire . . . how to handle fire-fighters. *Stage demonstrations. Show these men how extinguishers behave under fire.* We can help you do it.

A new Kidde handbook—"How to Teach Fire-Fighting"—tells how to stage a fast-moving, interesting, instructive demonstration of extinguishing methods. Send for your copy. Walter Kidde & Company, Inc., 625 Main St., Belleville, N. J.

Kidde PROTECTS LIVES

HIGH PRESSURE GASES • FIRE PROTECTION



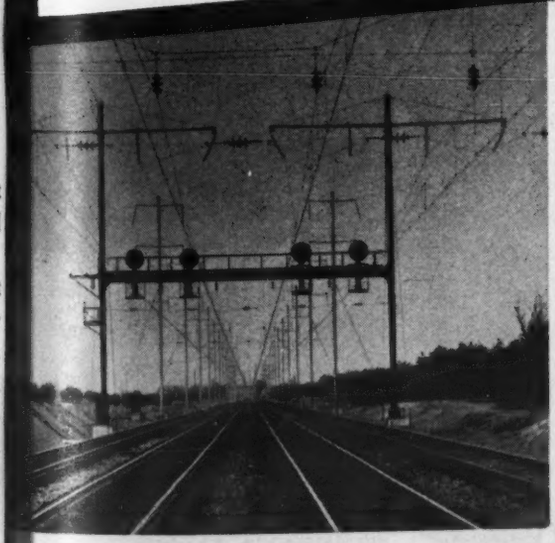
Engineering Resourcefulness

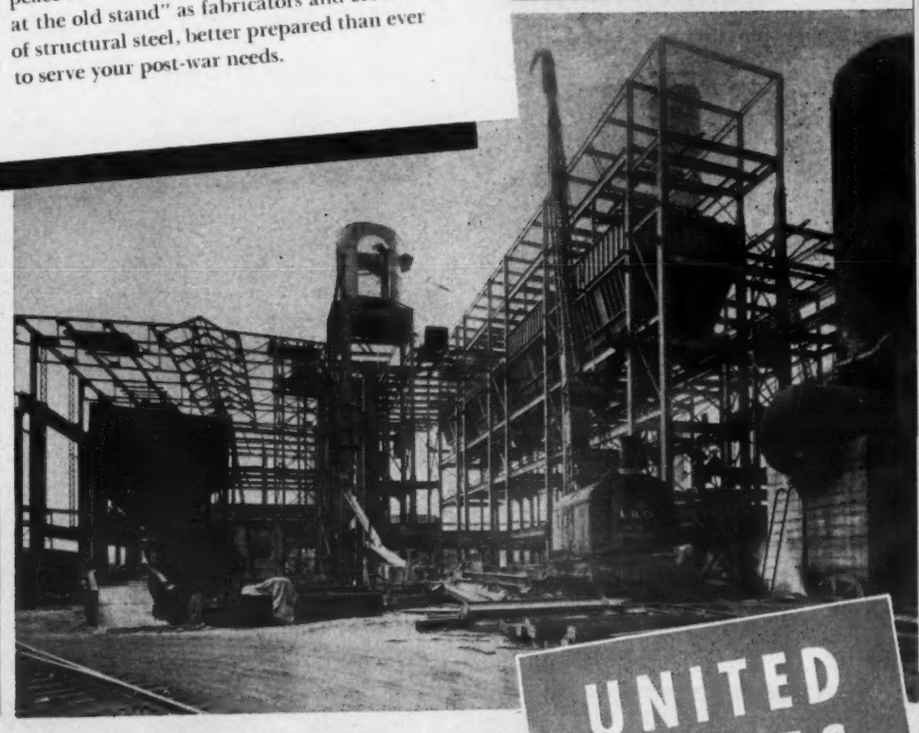
—a "plus" for your structural jobs

DURING the many years we have fabricated and erected steel structures for the electric power industry, one characteristic of American Bridge service has had more to do with the success of the jobs we have handled than anything else. It isn't a tangible factor. We can't write it into contracts. But every project benefits from it. You may have heard it called *engineering resourcefulness.*

What is this quality worth to you? . . . It means that every job American Bridge undertakes—whether it is the steelwork for a generating station, the towers for a transmission line, a substation structure, or an electrification project—will profit from an unsurpassed background of structural experience. It means that each project, no matter how large or how small, will receive the same painstaking care in planning, fabrication and construction.

Engineering resourcefulness gave our organization its worldwide scope of operation. This same resourcefulness now is enabling us to serve the war needs of our country in numerous ways, including even the manufacture of high-precision military equipment. We value this opportunity. But when peace returns, you'll find us "doing business at the old stand" as fabricators and erectors of structural steel, better prepared than ever to serve your post-war needs.





AMERICAN BRIDGE COMPANY

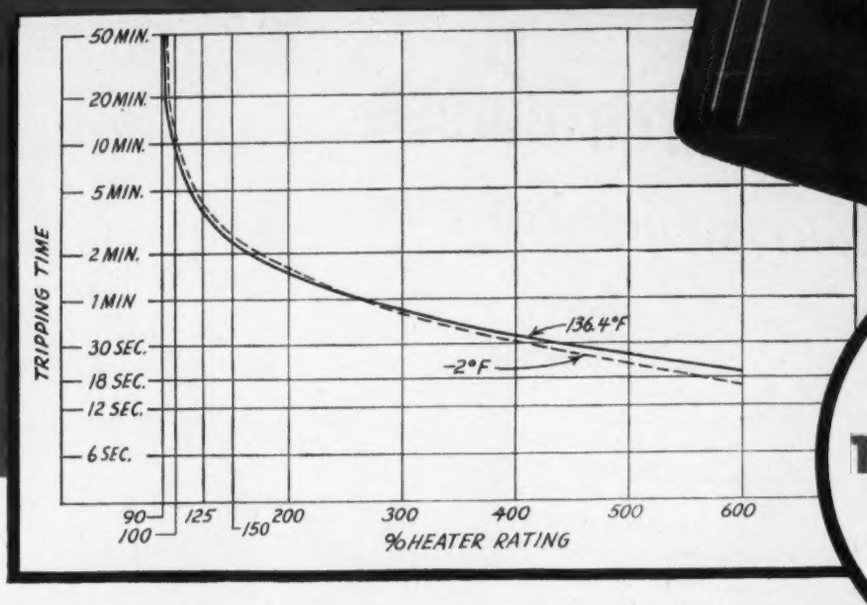
General Offices, Frick Building, Pittsburgh, Pa.

District Offices in: Baltimore · Boston · Chicago · Cincinnati · Cleveland
Denver · Detroit · Duluth · Minneapolis · New York · Philadelphia · St. Louis

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*
United States Steel Export Company, New York

USS UNITED STATES STEEL

How's This for MOTOR STARTER PERFORMANCE?



THE Monitor THERMALOAD V SOLENOID STARTER

MONITOR'S EXCLUSIVE *Compensated* OVERLOAD RELAY OVERCOMES HAZARDS OF AMBIENT TEMPERATURES . .

The above graph shows the average results of extensive testing of the Thermaload V equipped with the Monitor Compensated Overload Relay. Sample relays were subjected to a temperature of — 2°F., then the temperature was increased gradually until it reached a high of + 136.4° F. At intervals over the temperature range, the relays were subjected to varying overloads.

The two curves shown are the two extremes . . . —2° F. and + 136.4°F. Intermediate temperature curves have been eliminated for simplicity. What does this mean to you who depend on motor starters for motor protection? Simply this. Regardless of the normal temperature of the location in which you install this Monitor Across-the-Line Starter . . . regardless of how that temperature may vary from hour to hour or day to day . . . your almost irreplaceable motors will receive the same constant protection against overload. Your motors will last longer . . . maintenance costs will be reduced.

This feature and other important design features of the Thermaload V . . . plus a standard of quality that has characterized all Monitor Controls for fifty years . . . are reasons for a growing preference among designers and engineers for the Thermaload V . . . for original equipment and replacement.

Write manufacturer or your Monitor field engineer for technical data and installation details

★

Don't Overlook these Important Features of the Thermaload V

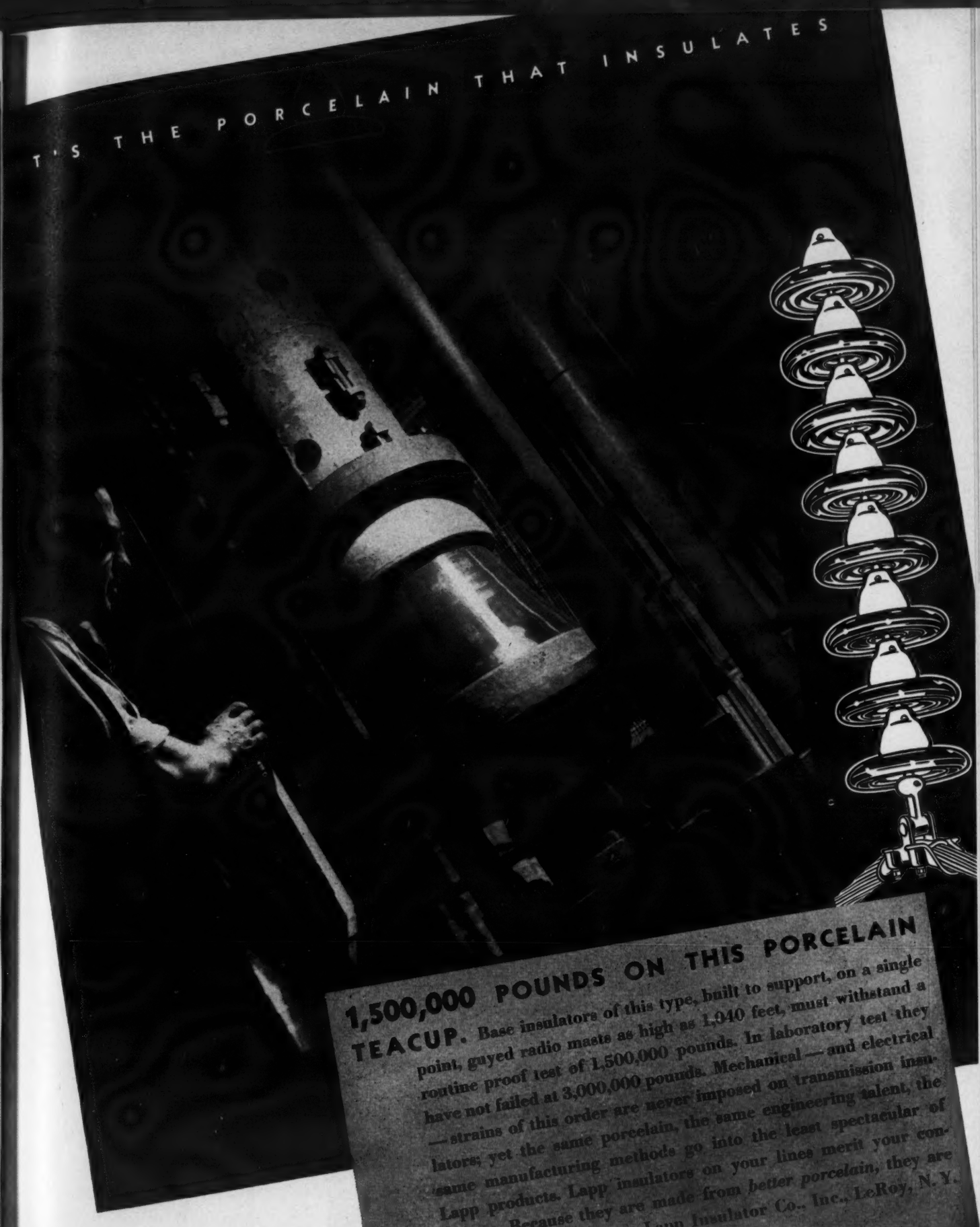
- COMPENSATED OVERLOAD RELAY
- VERTICAL, STRAIGHT-LINE DESIGN
- DOUBLE-BREAK, SILVER CONTACTS
- INTERCHANGEABLE COILS
- RESILIENT, SHOCK-PROOF MOUNTING
- TAMPER-PROOF PROTECTION

Available in 1.5 to 7.5 H.P.— 110 to 550 Volts (A.C.) and in combination units.

The Monitor Controller Company

GAY, LOMBARD & FREDERICK STS. BALTIMORE, MARYLAND

T'S THE PORCELAIN THAT INSULATES



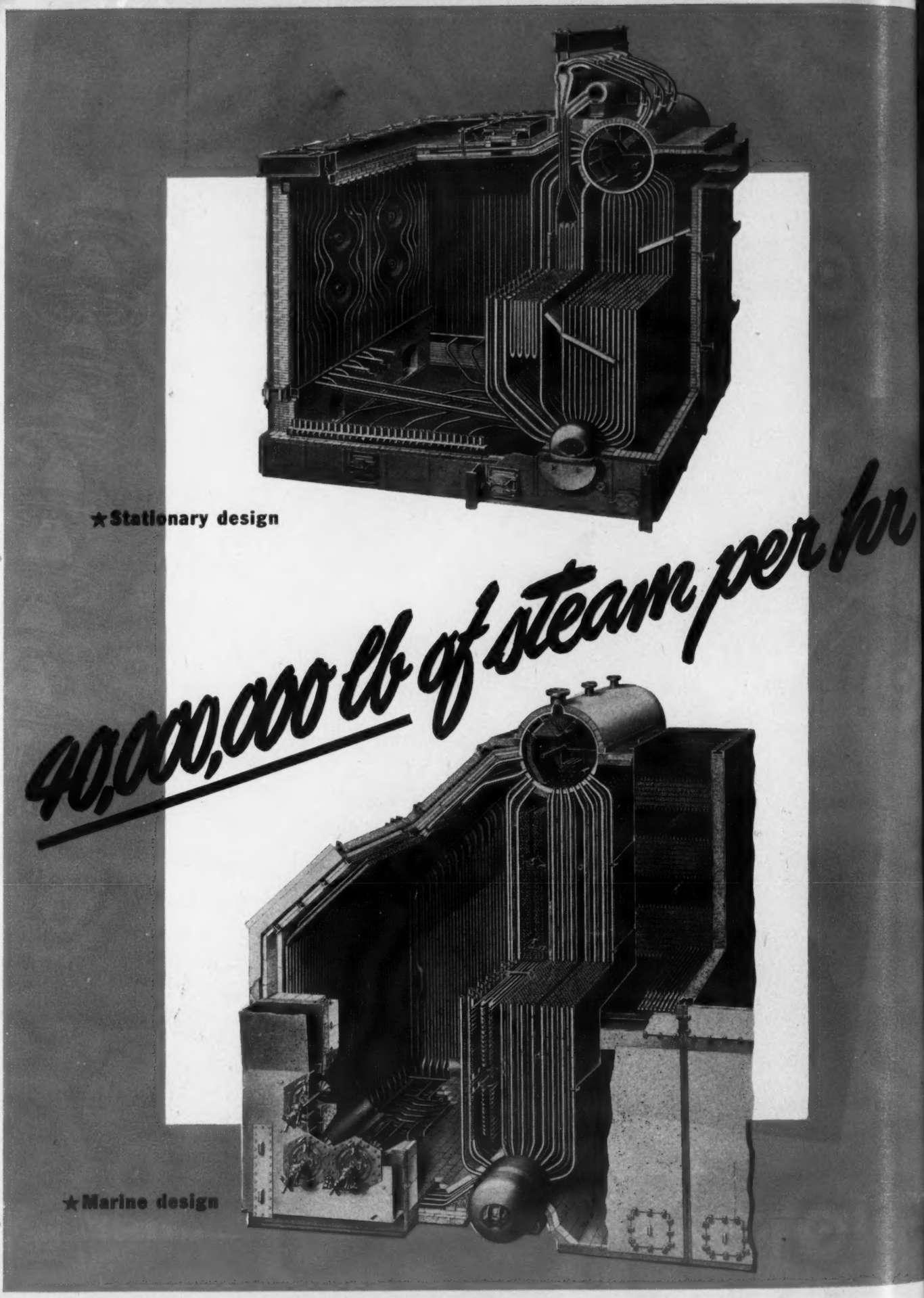
1,500,000 POUNDS ON THIS PORCELAIN TEACUP. Base insulators of this type, built to support, on a single point, guyed radio masts as high as 1,940 feet, must withstand a routine proof test of 1,500,000 pounds. In laboratory test they have not failed at 3,000,000 pounds. Mechanical—and electrical—strains of this order are never imposed on transmission insulators; yet the same porcelain, the same manufacturing methods go into the least spectacular of Lapp products. Lapp insulators on your lines merit your confidence. Because they are made from *better porcelain*, they are *better insulators.*

Lapp Insulator Co., Inc., LeRoy, N. Y.

ARMY E NAVY

Lapp

Better Porcelain • Better Insulators


★Stationary design
40,000,000 lb of steam per hr
★Marine design

Supplied by C-E Victory Units

FOR NAVY YARDS ★ MUNITIONS ★ ARSENALS ★ ORDNANCE ★ ARMY & NAVY BASES ★ SYNTHETIC RUBBER ★ HIGH OCTANE GAS ★ MARITIME COMMISSION SHIPS ★ NAVAL VESSELS

All over our country today — actually in 19 different states — and in U. S. Maritime Commission and Naval Ships on every ocean, Combustion Engineering Victory Units are right up there in the front line for victory.

For VU Steam Generator contracts for such vital installations as those listed above now have an aggregate capacity of over 40,000,000 lb of steam per hr. This rate of steam output would be sufficient to serve about 13 per cent of the total fuel-generated kilowatt capacity of all the public utility plants in the country.

And this doesn't include other millions of pounds of steam that give added significance to the name Victory Unit. For in many industrial and utility plants from coast to coast VU Units are supplying the power to produce planes, tanks, food, oil, clothing, guns, instruments, and scores of other war products.

It's logical, too, for the VU Unit to play this important role in war production. In time of peace it had an established reputation for quality, reliability and efficiency, and thus was a natural choice for a war-time job where trouble-free operation and continuous service are primary considerations.

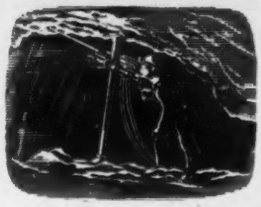
C-E

ARMY M E NAVY

A-732

COMBUSTION ENGINEERING

200 MADISON AVENUE, NEW YORK, N. Y.



FROM ORE TO FINISHED PRODUCT

CONDENSER TUBES

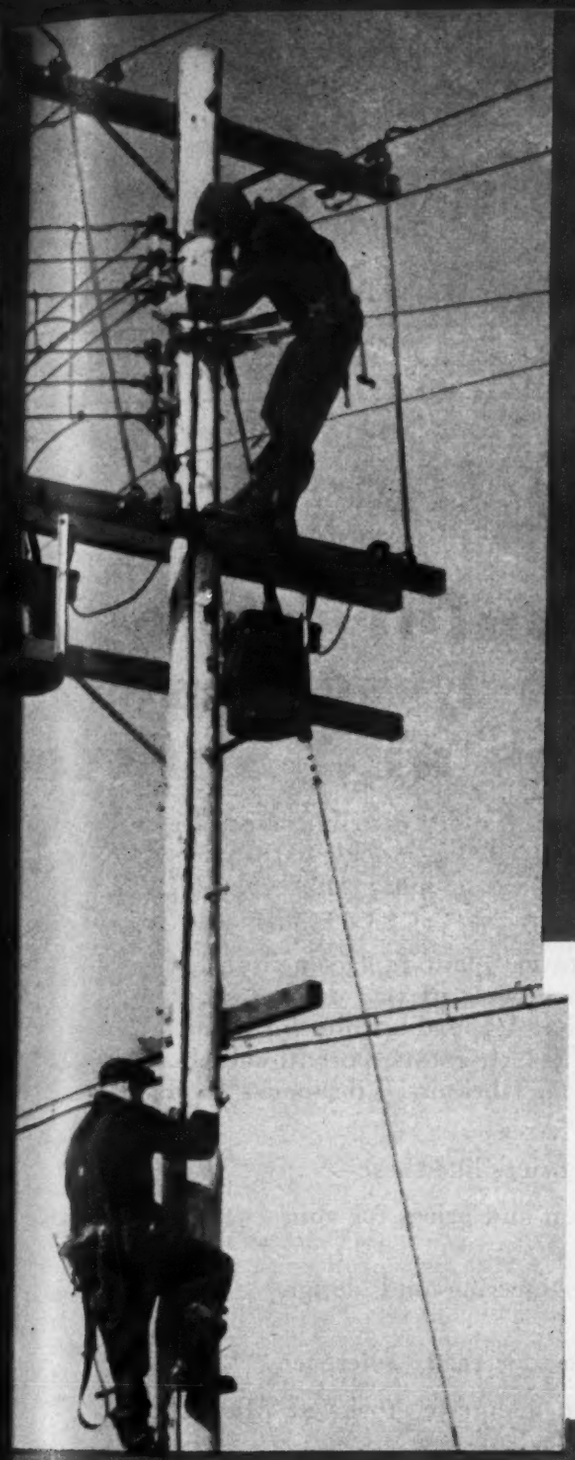
BUY WAR BONDS

CALUMET AND HECLA CONSOLIDATED COPPER COMPANY

WOLVERINE TUBE DIVISION

Seamless Copper — Brass

1427 CENTRAL AVENUE DETROIT, MICHIGAN



EXTRA SOUNDNESS MEANS EXTRA SAFETY

Here's Another Good Reason for Choosing

Life-Span

The Pole with a Future

FULL-LENGTH TOX-I-TIZING PROVIDES FULL-LENGTH RESISTANCE TO DECAY

By specifying Life-Span when you buy poles you obtain not only the many natural advantages of top-quality cedar but also the many added features provided by the Life-Span tox-i-tizing treatment. These include positive resistance to attacks by fungi and insects, added service life resulting from this long-term immunity and greater safety in climbing throughout the longer service life of the pole. The full-length tox-i-tizing combined with the regular incised butt treatment preserves the original soundness of the sapwood, makes the whole pole as decay resistant as the heartwood itself. For full protection, full-length—plus added protection at the ground line—be sure to specify Life-Span.

Sold Exclusively by the Following Firms:

SCHAEFER-HITCHCOCK CO.,
Sandpoint, Idaho, Supplier for Joslyn

NAUGLE POLE AND TIE CORP.,
Minneapolis, Minn.

LEAVITT-NAUGLE CO.,
Spokane, Wash.
205 West Wacker Drive, Chicago, Ill.

PAGE AND HILL CO.,
Minneapolis, Minn.
50 Church St., New York, N. Y.

B. J. CARNEY & CO.,
Spokane Minneapolis

pecify

LIFE-SPAN

ll-Length Treated

EDAR POLES

ONSOLIDATED TREATING CO.

nneapolis Minnesota

Quick, complete information and prices for your purchasing department.

Application data for your engineering and design departments.

Service from stock.

A copy of the Mallory catalog for ready reference.

Mallory Distributors Are on the Job With Essential Electronics Supplies and Servic

On small orders with high priorities, your Mallory distributor can be a life saver. He can supply you—usually from stock—with parts that might hold you up for months until the manufacturer can put them in production.

When you need essential electronic parts for plant replacements, test or experimental work, or pre-production models of war devices, your local Mallory distributor is at your service. Depend on him for standard Mallory switches, phone jacks and plugs, rheostats, potentiometers, resistors, condensers, rectifiers, noise filters, vibrators, Vibrapacks* and other Mallory Approved Precision Products.

Count on your Mallory distributor for services like these—

—Quick and complete information and prices for your Purchasing Department

—Application data for your engineering and design departments

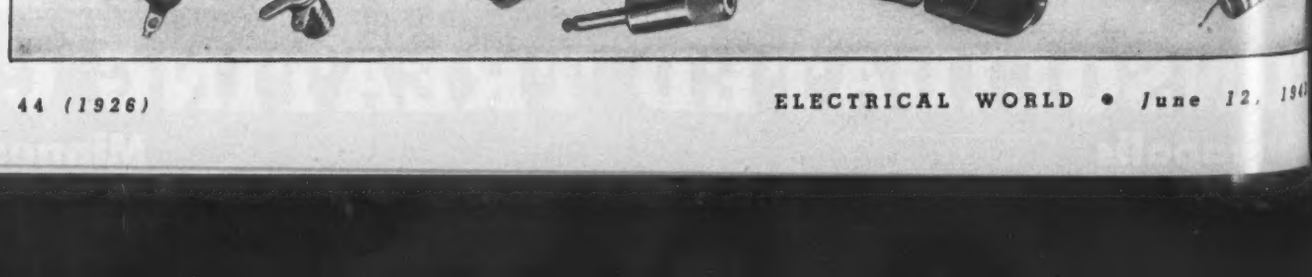
—A copy of the Mallory Catalog for ready reference

We are making every effort to maintain adequate stocks at Mallory distributors—to save you time and trouble.

Phone your local Mallory distributor. Or if you do not know the Mallory distributor nearest you—write us and we will put him in touch with you.

*Reg. U. S. Pat. Off.

P. R. MALLORY & CO., Inc. INDIANAPOLIS, INDIANA • Cable Address—PELMALL



Electrical Equipment—Weapons and Tools

From miniature motors to mammoth generators, from tiny detector tubes to great broadcasting stations—everything electrical is essential to our war effort

AS this editorial goes to press, newspapers and radio news commentators are telling the dramatic story of the blasting of two mighty Nazi power dams. Floods are sweeping down the Ruhr Valley, Germany's most vital munition production center. Two vast networks of industrial activity lie inert, for the great generators that had fed power to hundreds of plants producing war goods for Hitler, today stand idle. This daring raid will go down in history as one of the most, if not *the* most devastating of the entire war. It has destroyed two great sources of power, stopping the wheels in hundreds of plants and throwing into darkness thousands of factories and homes.

This epoch-making raid by the R.A.F. brings home to us the vital importance of our own power resources, those colossal generators from which flows the current that turns the wheels of our great industries, illuminates our factories and homes and runs our electric railways and subways. It makes us realize how dependent we are on electricity and how important is the part of those manufacturers who produce the electrical equipment that makes possible its generation and use.

Beginning with Thomas A. Edison, the inventive genius of electrical manufacturing men has devised more and more efficient ways of generating the current, better and better means of transmitting it and of applying it to do thousands of jobs quicker and better.

The products of electrical manufacturers have become so completely an essential component part of every industrial, business and domestic activity that our economy and our war effort could not go on without it.

In days of peace the laboratories of our electrical industry gave us radio, fluorescent lighting, infra-red drying, precision process-control, telemetering, split-second circuit breakers and many other things that border on the miraculous.

Today their facilities and their genius are devoted to an all-out war of wits with Axis scientists and production men.

Electricity plays a significant part in this war . . . from the "walkie-talkie" that brings support to hard-pressed outposts, to the mammoth motors on the battleships. While many electrical developments today are cloaked in secrecy, the nation will enthusiastically applaud these electrical manufacturers when the curtain is lifted.

The far-reaching importance of electrical instruments, apparatus and machines becomes evident when we consider that over 350 different electrical items go into combat vessels and that more than 170 go into a fighter plane. Most of these products are distinctly special in nature and are far removed from their civilian counterparts if, indeed, they have such counterparts.

To the civilian, a light bulb is something so standardized that every need can be filled by any nearby dealer. Our armed forces, by contrast, must have at their disposal more than 400 distinct types of lamps. Some no larger than the head of a match, are so brilliant that they flash signals under a tropical noon sky. Others are built to withstand extremely low temperatures, vibration, shock and many other abuses to which they are subjected.

On planes, for example, numerous fractional-horsepower motors are used but the standard industrial motor is not suitable for this service. New records in low weight-per-horsepower had to be achieved involving extensive changes in design and production.

To prevent the light from instrument panels from impairing the vision of night fighters, ultra-violet radiation which activates fluorescent instrument dials was developed. As a result, the pilot may look out into the darkness after reading his instruments without the least effect on his eyes. How many precious air victories can be credited to this one development alone?

But, in general, the story of this industry's war work is much too blurred by military censorship to afford an adequate picture of its contributions. The factories and shipyards that are turning out war matériel tell a more complete story. Many of these have been built during the past two years. Others have gone through a complete conversion process. In every case, large quantities of electrical materials were involved.

In the broadest sense, there are three major jobs which this industry has had to do, in addition to equipping our modern war machine. It has had to supply materials for the vast expansion of our industrial system, keep every plant fully maintained, and provide the necessary equipment for the vital power and communication fields.

More than $1,900,000,000 was spent for new industrial construction in 1942, and of this about 7% or $140,000,000 was for electrical materials. New machine tools and other production equipment required an additional $350,000,000 worth of electrical products. The conversion program called for another $145,000,000 of electrical apparatus and supplies.

This total of over $600,000,000 in itself would have staggered the electrical industry in a peace-time year. Yet, this record-breaking production was essential and had to be superimposed upon the direct requirements of the Army and Navy.

Industry depends upon electricity. Consider for a moment the effect of modern lighting upon war production. Industry enjoys levels of illumination and color quality that were undreamed of ten years ago. As a result, midnight shifts operate at daytime efficiency. As a matter of fact, many of the more modern plants have no windows at all.

Then there is maintenance. The failure of one single motor or feeder will stop a production line. Electrical manufacturers have had to stand at all times ready to

supply the heavy demand for the maintenance and repair parts that keep our industrial machine operating at top speed. Excess loads, 24-hour schedules and inexperienced production hands combine to shorten the lives of electrical equipment.

Electrical manufacturers have had to supply the greatly expanded needs of our power and communication systems.

New construction of all sorts — war plants, cantonments, war housing — has created a formidable need for additional capacity. Every element in our domestic economy has called for increased communication and power services. All this had to be superimposed upon the vast demands of our armed forces. The magnitude of this task is obvious but it is being successfully accomplished. Every old installation is functioning smoothly and every new one has been ready to function on exact schedule. There has been no failure either in our power or in our communication. Part of the credit for this performance belongs to the hundreds of manufacturers who delivered their products when and where they were needed.

This was not merely a problem of increasing production. These manufacturers had been depending on rubber, copper, aluminum and steel — all highly critical materials. For much of their non-military production they suddenly had either to find substitutes or practice the utmost economy and ingenuity.

Solutions to many problems were quickly found. Lighting manufacturers greatly reduced their use of steel by designing efficient, non-metallic reflectors. Wire and cable manufacturers expanded their use of synthetic insulation in place of rubber and they promoted the use of higher distribution voltages so that every ounce of copper would work more efficiently.

Steel is essential in apparatus that operates magnetically. There is no known substitute. But marked economies in its use have been achieved through the development of new alloys that are of increased magnetic efficiency. As a result, motors and transformers now consume substantially less steel than did units of equal capacity a year or two ago.

Electrical manufacturers have given our industries numerous new production tools. Infra-red heating tunnels, for example, have drastically reduced the time involved in production drying . . . in some cases from hours to minutes. High-frequency induction-heating has been spectacularly successful in the forging, brazing, hardening and casting of ordnance. Modern welding equipment makes possible speedy production with inexperienced labor.

America's production lines are being patrolled by electrical devices which eliminate human error. One million volt X-ray equipment looks through castings and points an unfailing finger at defects. An electronic flaw detector tests nonferrous drawn-metal tubing for imperfections. Other electronic devices are counting and sorting the products of thousands of war plants. Precision controls regulate all sorts of processes, from aluminum production to armor plate annealing.

These are but a few of many examples of the way in which the magic power of electricity has been harnessed to the war effort. Back of every development there is at least one electrical manufacturer — more often many — who have pooled ideas and methods with no thought of royalties or dispute over cost allocation.

No story of the electrical industry would be complete that did not pay tribute to those manufacturers who have dropped their normal lines in order to produce special war products. Many appliance manufacturers fall in this group. When war came, they did not stop to argue that civilian morale and big pay checks would demand a continued supply of their products, instead they quickly shifted to the production of war matériel and today they are deep in the manufacture of machine gun parts, aircraft sub-assemblies, and even gas-mask fabric. They have had to abandon their hard-won markets for the duration; but they are contributing mightily to permanent peace and a more prosperous world to which they will return when the guns are silenced.

This great industry has increased its production threefold in two years — $2,500,000,000 in 1940 to $7,500,000,000 in 1942. It has done this with all the zest of youth, for this is a young and a pioneering industry. Few companies in this industry are fifty years old; the majority are much younger. Top management in general is young, too, and many outstanding technical developments have come from the brains of men just a few years out of college.

The results of all its intensive intelligent work can be found in every factory, on every battlefield and ocean, and even in the flak-spotted air over Berlin. In a sense, the electrical manufacturing industry stands beside every soldier and every sailor as he goes into action. It has a place of honor it richly deserves.

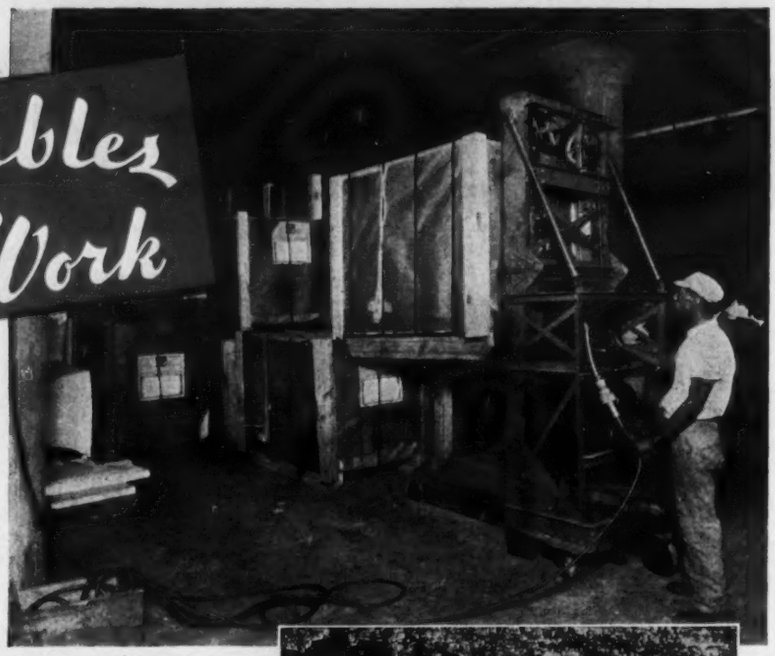
And when this war passes into history, as it surely will, our soldiers and sailors returning to peace-time jobs, will find a life greatly enriched by electrical developments that were undreamed of yesterday.

This is the twelfth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

Trailing Cables FOR Vital WAR Work



TIREX - rubber sheathed - cables were designed for hard, rough work. They still have remarkable wearing qualities and abrasion resistance and can be depended upon for continuous, dependable performance but, for the duration of the war, they meet restrictions governing the use of rubber, copper and other scarce materials.

It is important, now more than ever before, to get maximum service from trailing cables upon which portable or mobile electrical equipment depends for current. New cables are hard to get and those already in service must be used until they are completely worn out. To this end we make four suggestions.

1. As far as possible use the proper size and type of cable for the work to be done.
2. Provide extra protection or change location where exposure is hazardous.
3. Inspect cables frequently and regularly to discover conditions that may cause trouble.
4. Make repairs promptly when needed.

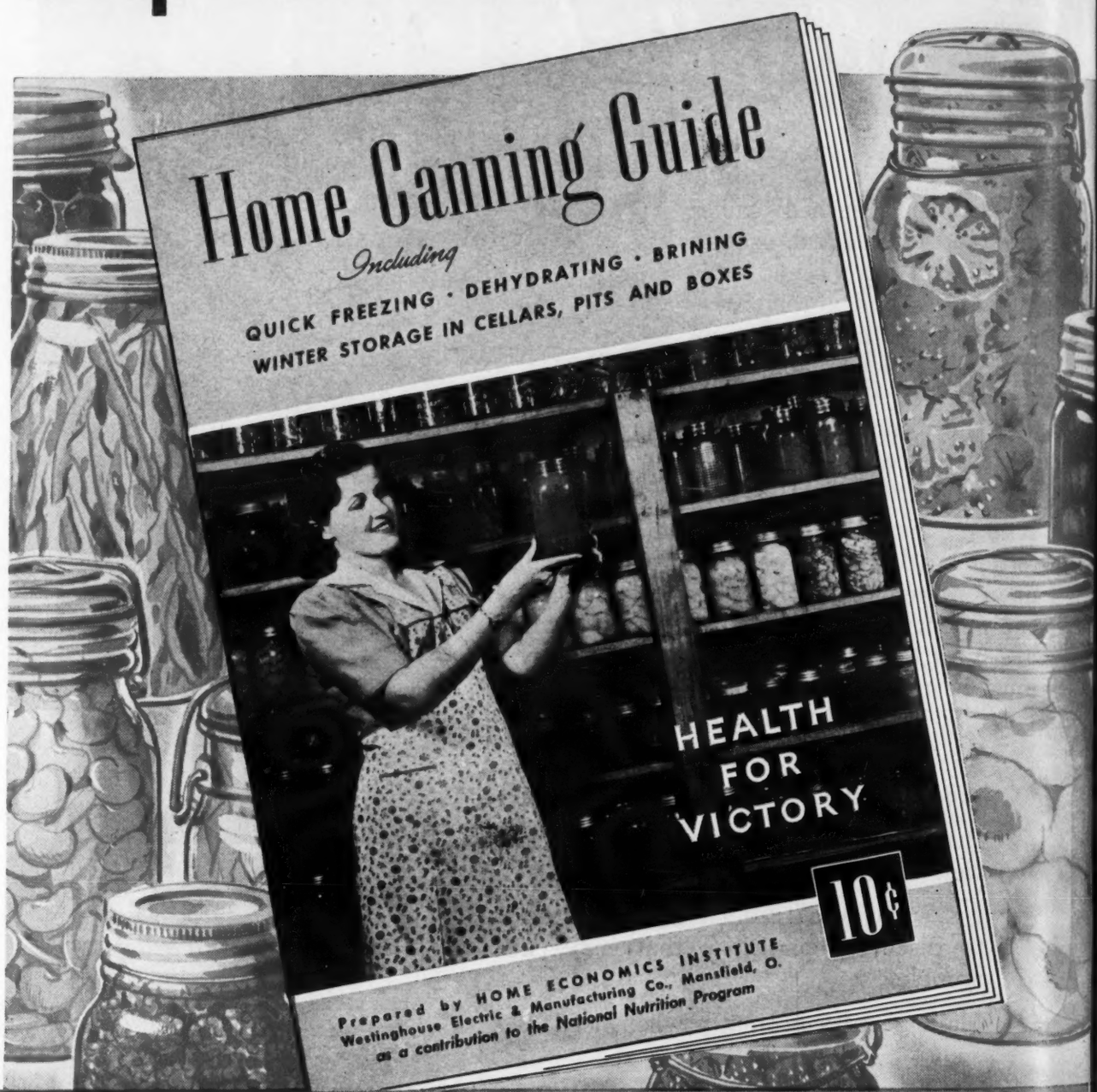
If you must have new cables for vital war work we shall be pleased to do anything we can, consistent with conservation restrictions, to help you get what you need.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

ARMY E NAVY

Simplex WIRES and CABLES

Help America Preserve the


Home Canning Guide
Including
QUICK FREEZING · DEHYDRATING · BRINING
WINTER STORAGE IN CELLARS, PITS AND BOXES
HEALTH FOR VICTORY
10¢
Prepared by HOME ECONOMICS INSTITUTE
Westinghouse Electric & Manufacturing Co., Mansfield, O.
as a contribution to the National Nutrition Program

Westinghouse

Victory Garden Harvest!

48 PAGES OF WARTIME CANNING INFORMATION. DETAILED "HOW TO DO IT" INSTRUCTIONS ON:

1. Four methods of home canning. 2. Dehydrating fruits and vegetables. 3. Brining foods. 4. Quick freezing. 5. Storage in pits and boxes.

Here's a book that's a natural. Something that's going to be eagerly welcomed by the hundreds of victory gardeners in your community.

For the fact of the matter is this: To many women, canning is a new experience. Also, they're shy of information on other methods of food preservation — such as dehydration, brining and quick freezing.

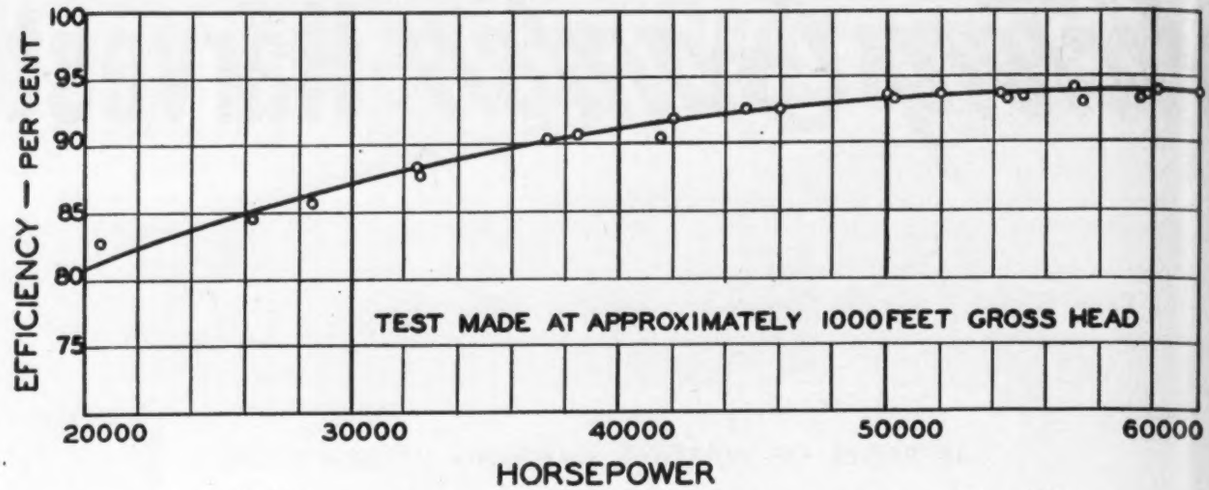
You can do these women a real turn, and at the same time render a patriotic service, by offering this complete, up-to-the-minute volume.

Prepared by Julia Kiene, Director of the Westinghouse Home Economics Institute, it's brimful of hints and tips—and it answers just about every question on food preservation that a woman could ask.

The Home Canning Guide carries a price of 10c on the cover. Most retailers will give it away, however, and in so doing will find themselves taking a lot of bows from grateful customers.

Price to you is $4.50 per hundred, f.o.b., Mansfield, Ohio. The canning season is here. We suggest you place your order at once with the Westinghouse Electric Appliance Distributor who serves your area.

Electric Home Appliances



FIELD TEST CURVE

for

60,000 H.P.–925′ NET HEAD–450 R.P.M.

VERTICAL FRANCIS TURBINE

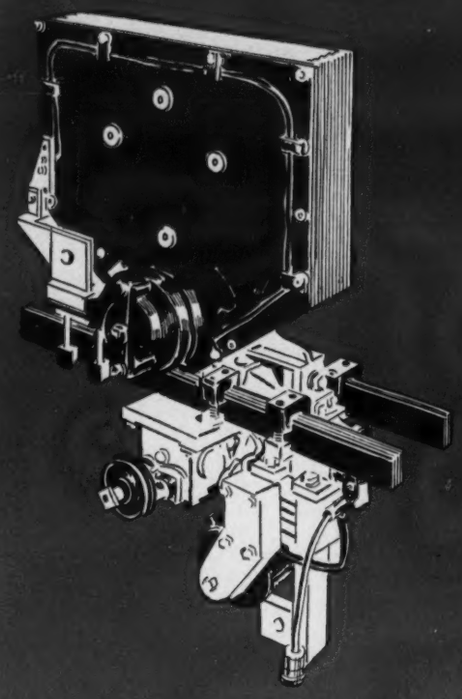
Built by

NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY

HYDRAULIC TURBINE DIVISION

Newport News, Virginia

Our facilities for building turbines,
valves, rack rakes, gates, etc., are now in use for constructing
ships for the Navy



WHEN YOU'RE COUNTING TIME IN SPLIT-CYCLES

Switchgear, built to function in a fraction of a cycle, can't be hampered by excess weight. Manufacturers met that issue by making moving parts of aluminum. They greatly reduced inertia, with a consequent lessening of hammer-blow. Equipment was made strong and sturdy.

Today, this high-speed switching and control apparatus is up to its neck in war work, helping to push production and protect the equipment at the same time. Tomorrow's designs will profit by the lessons learned today. The postwar era is certain to see the field of high-speed switching greatly expanded and refined.

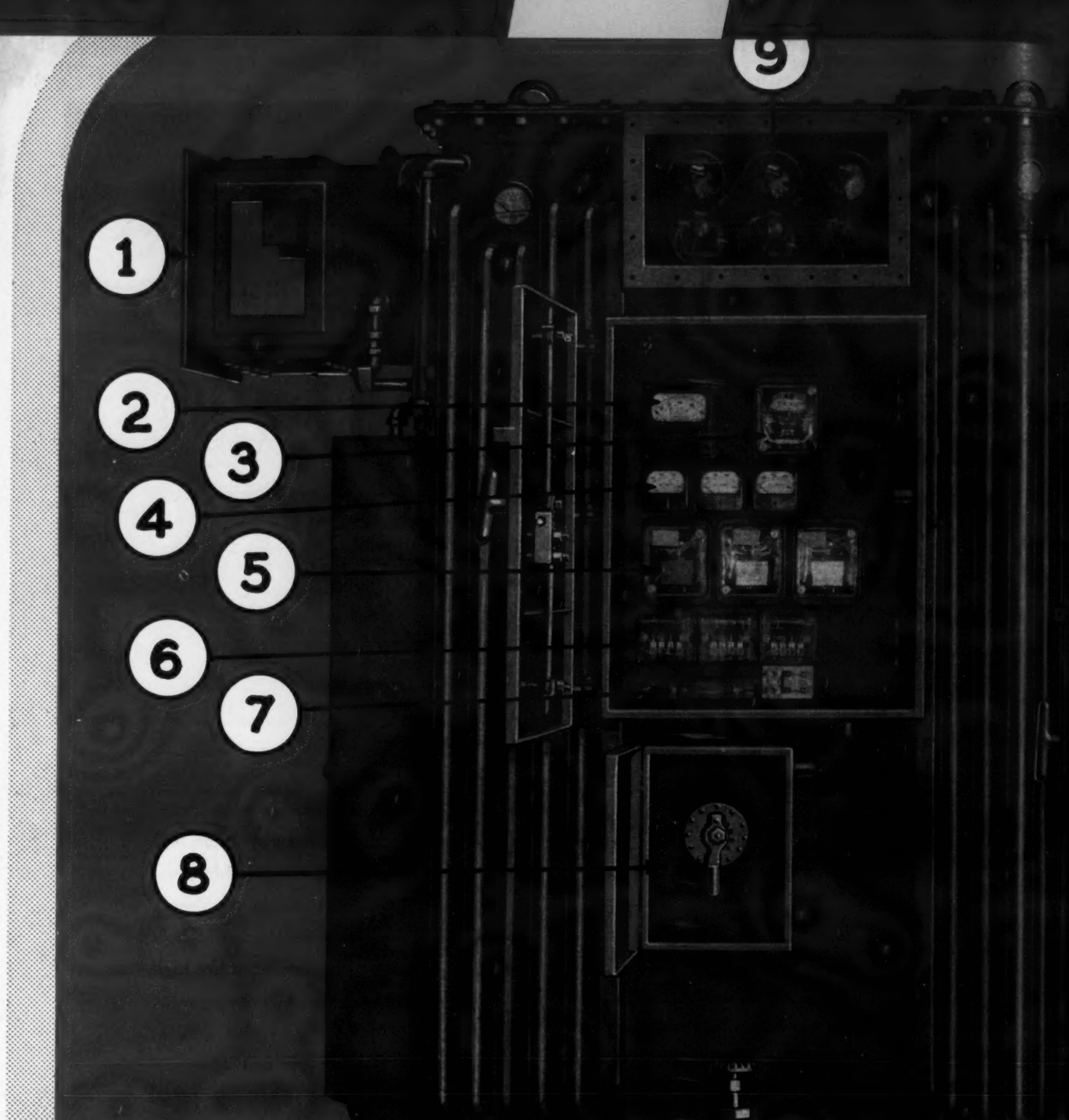
Have you considered what aluminum and its high strength alloys will do for your postwar equipment, doubtless still in the dream stage? They offer light weight with high strength and sturdiness. Aluminum has high electrical conductivity and is nonmagnetic. It is highly resistant to corrosive attack.

Operators of power lines and electrical bus systems have learned to depend on all of these properties of aluminum to improve the performance of their construction. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pennsylvania.

IMAGINEERING AT WORK

ALCOA A·C·S·R

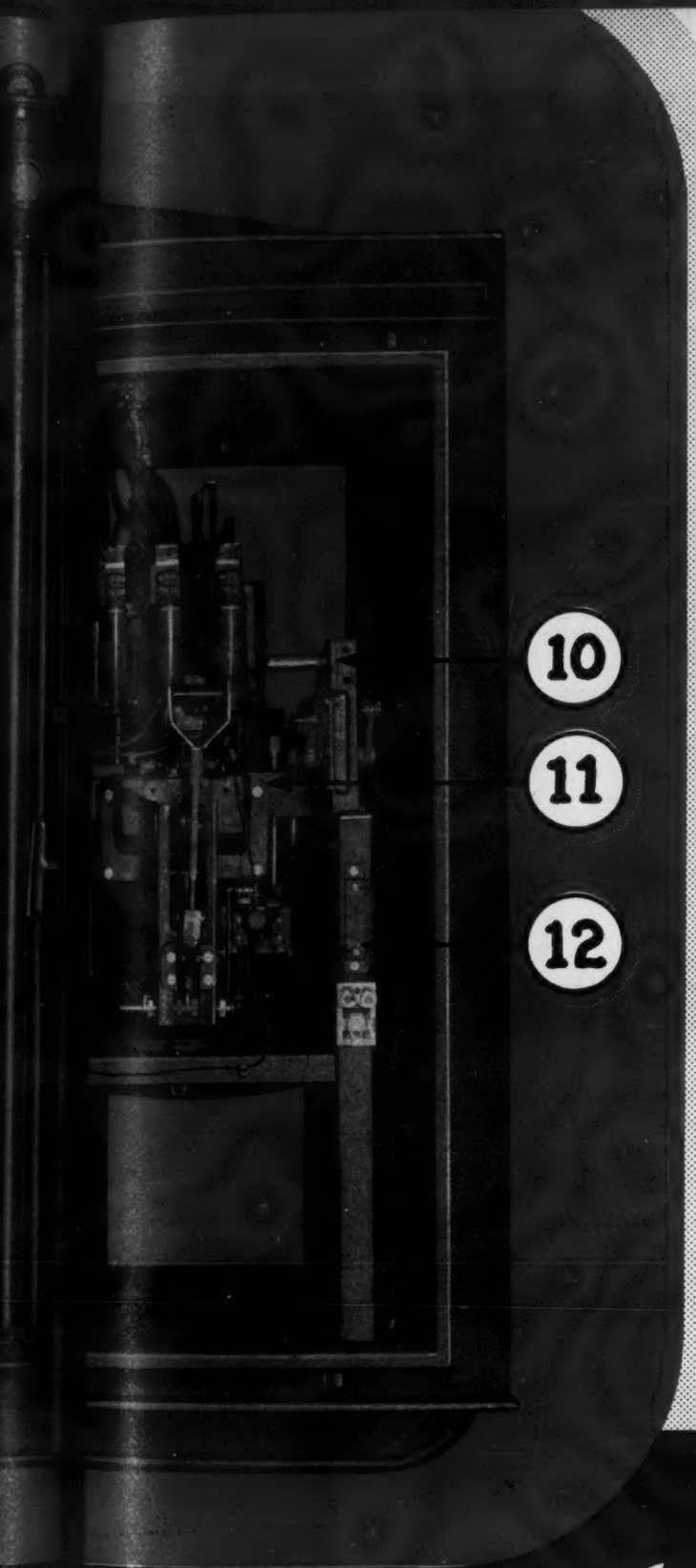
ALUMINUM CABLE STEEL REINFORCED



Listed are component parts of Unit Sub Station

1. Secondary bus bar connections in junction box.
2. Voltmeter—secondary.
3. Watt-hour meter.
4. Ammeters—secondary.
5. Induction overcurrent relays.
6. Relay test switches.
7. Element heater for cabinet.
8. Tapchanger cabinet.
9. Mercoid temperature control switches.
10. Isolator operation handle.
11. Oil circuit breaker, 15 kilovolt., 600 amperes, electrically interlocked with isolator.
12. Element heater for cabinet.

TRADE MARK Standard



Here is a Unit Sub Station containing in a compact design all the essential equipment for complete power transformer service.

This 1000 KVA transformer, rated 11,500 volts primary, 460-Y secondary, 3 phase, 60 cycle, was shipped recently to one of our Navy Yards to handle the power distribution needs of that vital Naval Station.

Like all STANDARD Transformers, this unit was designed for a specific service—built by an experienced organization—constructed to withstand the severe service and long hours of operation required of a Naval Base in War time.

And looking ahead to the time when we get back to normal operation this STANDARD Transformer will still be in service meeting the less strenuous but equally important job of power distribution required to build up a stronger Navy than ever, for the protection of America.

STANDARD Transformer has both the engineering and manufacturing facilities to produce all types of transformers—they'll build the size, type and number required to meet your needs. For dependable, low cost power distribution consult a STANDARD Engineer on the type transformer best suited to your needs. Write or wire . . .

THE STANDARD TRANSFORMER CO.

WARREN • OHIO

10

11

12

d Transformers

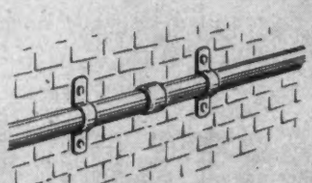
ENGINEERED AND BUILT
TO MEET YOUR SPECIFIC NEEDS

DO YOU KNOW THESE FACTS ABOUT TRANSITE DUCTS?

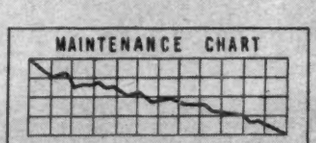
TRANSITE CONDUIT

This durable duct is for use underground, or on exposed locations without a protective casing . . .

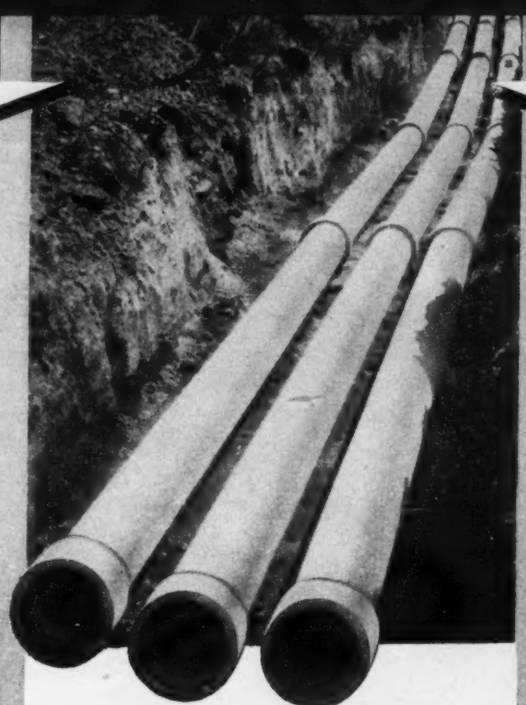
Under sustained earth loads and traffic pressure, it maintains its strength and true form . . .



Transite Conduit effectively resists weather, smoke and fumes...is virtually unaffected by corrosive soils...



Its cost is low and, in service, it is much more economical than other materials of comparable strength and durability.



. . . In addition, both Transite Conduit and Transite Korduct have these characteristics . . .

1. Incombustible—Made of asbestos and cement, they cannot burn . . . will not contribute to the formation of dangerous smoke, fumes or gases.

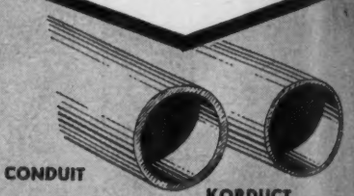
2. Immune to electrolysis . . .Transite Ducts are non-metallic and inorganic . . . unaffected by electrolysis.

3. Smooth bore—Making cable pulls easier, both at initial installation and after years of service.

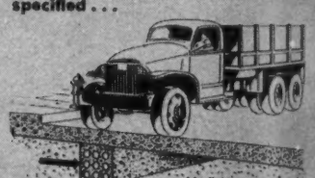
4. Easily installed—Lining up is fast and accurate because Transite Ducts combine light weight, long lengths, simple assembly.

For details and specifications, write for Data Book DS-410. Johns-Manville, 22 E. 40th St., New York.

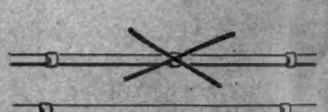
TRANSITE KORDUCT



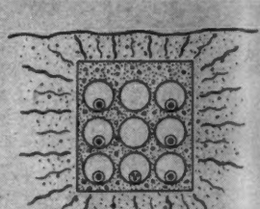
Thinner walled, lower priced than Transite Conduit, Transite Korduct is for use where an encasement is specified . . .



Because Korduct is incombustible, less concrete is required between ducts to provide the necessary degree of fire protection.



Its long lengths (10 feet) mean fewer joints, reducing the number of spacers required . . .



Its high rate of heat dissipation lowers cable operating temperatures . . . increases system capacity . . .

Johns-Manville

TRANSITE DUCTS

TRANSITE KORDUCT—for installation in concrete

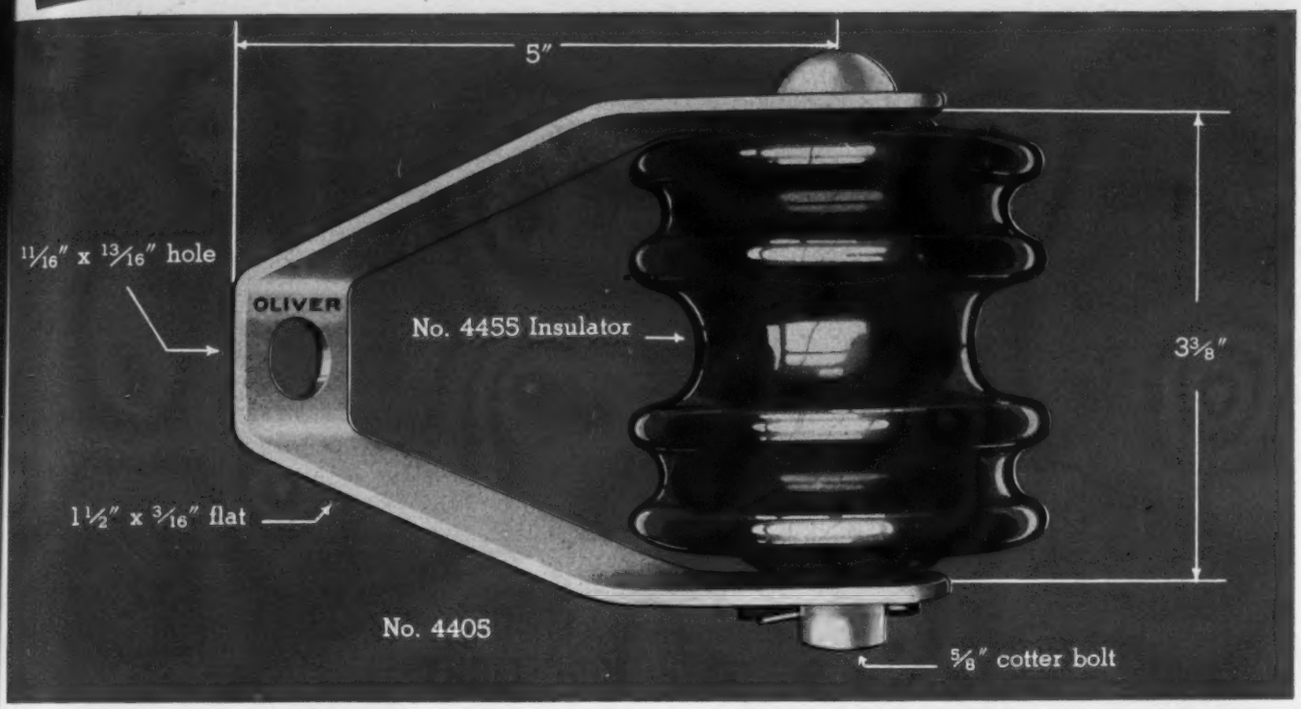
TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

... from the COMPLETE LINE OF

OLIVER

POLE LINE MATERIALS

CLEVISES

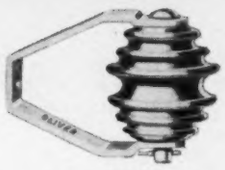


Of all the Oliver products used by linemen, there is probably no group of items more generally useful and necessary than Clevises. For dead-ending, for service take-off, for corner installations, for breaking wires—Oliver Clevises, in a score of types and sizes are designed to solve all line construction problems.

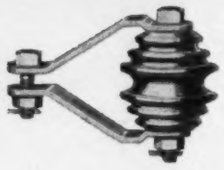
As indicated by the illustrations, Oliver Clevises are offered with a variety of designs for rigid or flexible mounting, and with insulators specially designed for the type of service desired. All steel parts are of mild open-hearth steel hot-dip galvanized. Insulators are of brown glazed porcelain, wet process porcelain being used for dead-ending primary lines and dry process for secondary lines. White-glazed insulators for designating neutral circuits can be supplied also.

For attaching clevises to crossarms, poles, buildings, Oliver makes several types of devices that speed erection and assure dependable mounting.

Our engineers will be glad to show you how Oliver Clevises are being widely used in a variety of ways.



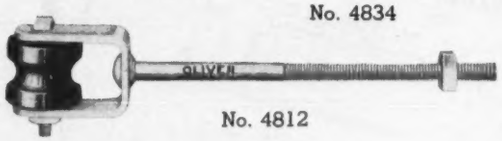
No. 4413



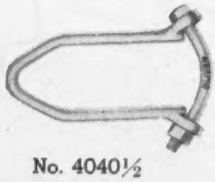
No. 4412

No. 4425

No. 4834



No. 4812



No. 4040½

No. 4220

OLIVER
IRON AND STEEL
Corporation

Makers of Pole Line Materials Since 1894

PITTSBURGH, PENNSYLVANIA

SYLVANIA *proudly announces*

MORE LIGHT FROM LESS WEIGHT

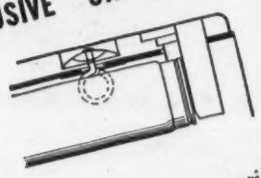
Sylvania pioneered composition reflectors for fluorescent fixtures and "proved them in industry."

This composition reflector has an efficiency of 86 per cent—even higher than that of prewar porcelain-enameled metal in conventional contours.

It is fabricated to Sylvania's specifications from a strong and durable composition. Coated with MIRACOAT inside and a handsome French Gray outside, it stands up under extreme humidity and temperature conditions. Also it is impervious to frequent washings.

It gives more light. It's lighter and easier to handle.

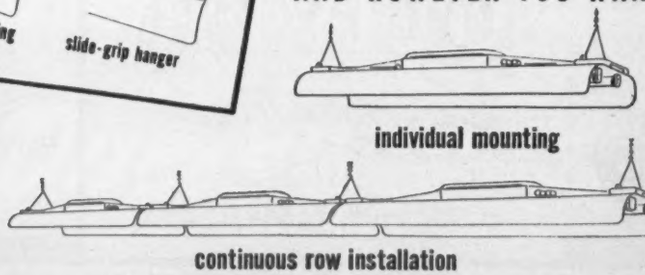
EXCLUSIVE "CAPTIVE LATCH"



This Sylvania-developed spring-type fastener saves installation and maintenance man-hours. It stays put while lamp is in service despite any kind of vibration. It locks or unlocks with a simple quarter turn. No tools are necessary.

HANG IT ANY WAY YOU WANT

AND HOWEVER YOU WANT



THE FLUORESCENT FIXTURE OF THE FUTURE!

- EASIER INSTALLATION
- SPEEDIER MAINTENANCE
- SINGLE OR CONTINUOUS ROW INSTALLATION
- SIMPLE
- STANDARD
- REGULAR SIZE USES 2 OR 3 40-WATT LAMPS
- LARGE SIZE USES 2 100-WATT LAMPS

This adds up to a modern, standard, adaptable fluorescent fixture that eliminates installation headaches and stock troubles.

HERE'S what you've been hoping for—years ahead of time—a fluorescent fixture that has "everything"—the fixture of the future NOW.

Once again Sylvania engineers have taken another long step forward, and designed a unique industrial fixture without metallic reflector, with top-housing under three pounds. Their perfected design is a revelation of simplicity and adaptability.

This new Sylvania fixture is made in two sizes—for 100-watt and 40-watt lamps. In either length, *one* standard fixture will fill any industrial lighting requirement.

. . . Can be installed singly or in continuous rows.

. . . Can be stem-mounted, surface-mounted, mounted with chains or slide-grip hangers.

. . . Can take either two or three lamps.

This one-for-all-purpose adaptability is attained by the streamlined top-housing that encloses the ballast, protects it and provides cooler performance. One-half-inch center knock-outs at centers of 18, 24, 30 and 36 inches provide for any type of mounting. The starter sockets are readily accessible, and there is a convenient knock-out for a pull-chain switch if desired.

This is the fluorescent fixture of the future that the trade has been waiting for. It meets all WPB requirements, carries Underwriters' Laboratories approval and our own standard guarantee. For specifications and prices, write Dept. X-00, Sylvania, Ipswich, Mass.

"Everything that's Finest in Fluorescent"

SYLVANIA ELECTRIC PRODUCTS INC.

Fluorescent Fixture Division, Ipswich, Mass.

INCANDESCENT LAMPS, FLUORESCENT LAMPS, FIXTURES AND ACCESSORIES, RADIO TUBES, ELECTRONIC DEVICES

Save to Win with these four simple rules of battery care:

1. Keep adding approved water at regular intervals. Most local water is safe. Ask us if yours is safe.
2. Keep the top of the battery and battery container clean and dry at all times. This will assure maximum protection of the inner parts.
3. Keep the battery fully charged—but avoid excessive over-charge. A storage battery will last longer when charged at its proper voltage.
4. Record water additions, voltage, and gravity readings. Don't trust your memory. Write down a complete record of your battery's life history. Compare readings.

If you wish more detailed information, or have a special battery maintenance problem, don't hesitate to write to Exide. We want you to get the long-life built into every Exide Battery. Ask for booklet Form 3225.

Exide
CHLORIDE BATTERIES

. . . is a vital principle of utility operation!

Conservation of materials is no new story to American utility men. With thrift and efficiency they have always planned for conservation.

They've squeezed the last ounce of use out of materials in their care . . . and today, that need is intensified.

One helpful principle to follow is that of "Buy to Last—Save to Win." Buy quality products and equipment, then care for them to avoid needless replacement. That conserves raw materials, labor, and space in factories. It frees these productive elements for essential war production.

THE ELECTRIC STORAGE BATTERY CO., Philadelphia
Exide Batteries of Canada, Limited, Toronto

Synonymous with Quality!

Wagner TRANSFORMERS

reflect sound engineering and modern manufacturing methods . . .

★ ★ ★

POWER DISTRIBUTION AIR-COOLED NOFLAMOL*

***(NON-INFLAMMABLE LIQUID FILLED)**

WAGNER BRANCH OFFICES

ATLANTA
BALTIMORE
BOSTON
BUFFALO
CHICAGO
CINCINNATI
CLEVELAND
DALLAS
DENVER
DETROIT
HOUSTON
INDIANAPOLIS
KANSAS CITY
LOS ANGELES
MEMPHIS
MILWAUKEE
MINNEAPOLIS
NEW YORK
OMAHA
PHILADELPHIA
PITTSBURGH
PORTLAND
ST. LOUIS
SALT LAKE CITY
SAN FRANCISCO
SEATTLE
SYRACUSE
TULSA
WASHINGTON, D.C.

In army camps, ordnance and power plants, in the oil fields, and throughout the chemical and steel industries, Wagner transformers daily demonstrate their excellence in quality. From the very beginning, the name Wagner has been *synonymous with quality.*

If you are in need of transformers to complete your war production schedules, consult the nearest of Wagner's 29 branch offices, located in principal cities and manned by trained field engineers.

Write

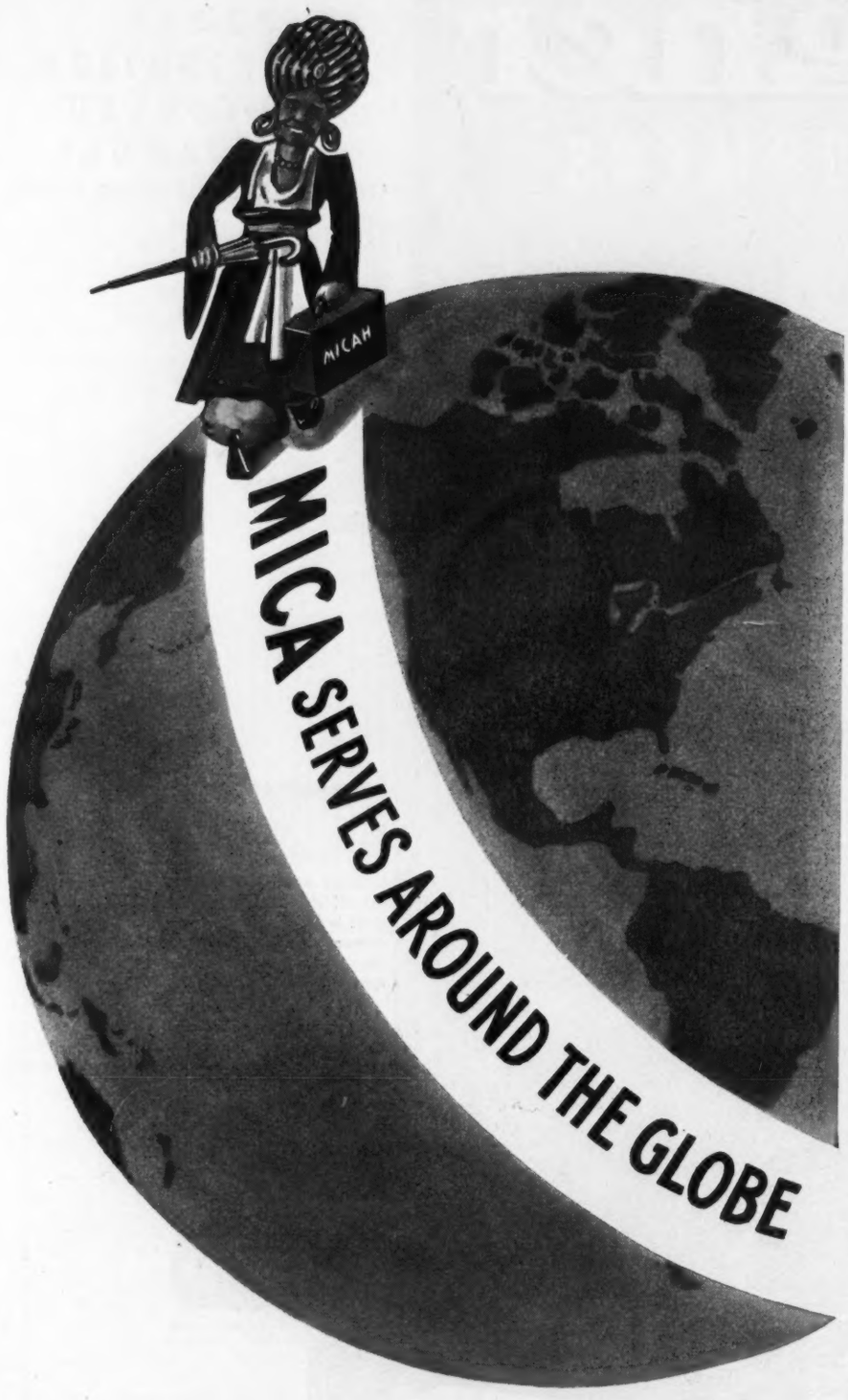
FOR BULLETINS
TU-33 (NOFLAMOL)
TU-181 (POWER)
TU-180 (DISTRIBUTION)

T43-4

Wagner Electric Corporation

ESTABLISHED 1891
6456 Plymouth Avenue, St. Louis, Mo., U. S. A.
ELECTRICAL AND AUTOMOTIVE PRODUCTS

★ ★ ★



We could truthfully illustrate this advertisement with ships, planes, tanks, or jeeps — with practically any electrified piece of mechanism serving on the fighting line or on the production line. In every one of these devices somewhere — *motor, generator, transformer, tube or control*, there is a vital spot where the maximum of insulation dependability is essential — and there you find *Mica*. In many cases it is *Macallen Mica*.

In your product engineering work for post war production you are going to use *Mica* where no substitution is possible — and also for that extra margin of safety, you will use *Mica* wherever there is any element of doubt.

Macallen Mica is the product of 50 years of specialized skill and experience in processing *Mica* to its greatest possible usefulness. Our engineering department will cooperate with you.

50th Anniversary book — Macallen & Mica — Yours for the asking.

PRODUCTS

Compressed Sheets—Mica Paper, Cloth, Tape, Heater Plate, Compressed Sheet Tubing—Commutator Insulation—Compressed Sheet Washers—Insulating Joints and Canopy Insulators—Railway Specialties—Domestic and Imported Raw Mica.

THE MACALLEN COMPANY

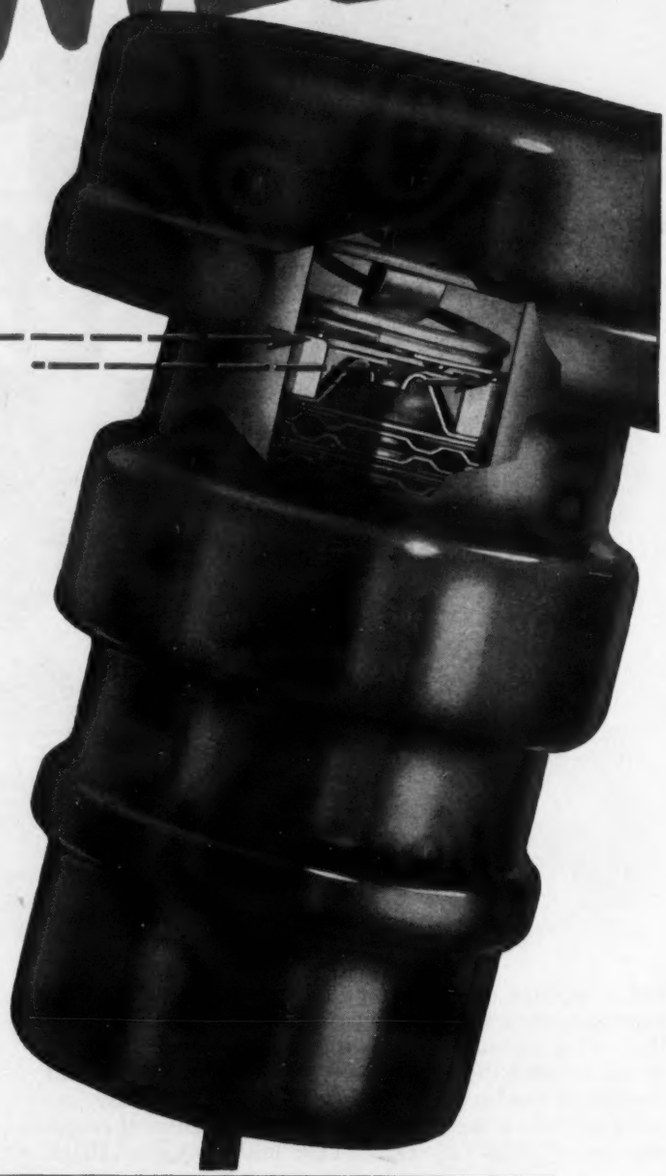
16 MACALLEN ST. BOSTON

CHICAGO: 565 W. WASHINGTON BLVD.
CLEVELAND: 1005 LEADER BLDG.

WESTINGHOUSE AUTOVALVE ARRESTERS

"VITAMINIZED"

with pre-ionizing tips...



Just as vitamins fortify the human body against sudden attacks of disease—pre-ionizing tips make Westinghouse Autovalve Arresters immune from erratic spark-overs.

With pre-ionizing tips, Westinghouse Autovalve Arresters safeguard vital war equipment by establishing uniform and reliable gap breakdowns.

The pre-ionizing tips—an exclusive Westinghouse feature—accelerate *complete* ionization of the gap and act as a trigger causing the arrester to "spill over" at established breakdown values.

A RECOMMENDATION. Check lightning arrester protection for your distribution equipment now.

Make sure of maximum protection by standardizing on Westinghouse LV Autovalve Arresters. Available in 3 to 15 kv ratings. For full information call nearest Westinghouse office or write Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-60526

OTHER PROTECTION FEATURES OF WESTINGHOUSE LV ARRESTERS

DROP-OUT FEATURE prevents line lockout.

QUENCH GAP stops power follow current beyond next zero point of current wave.

AUTOVALVE BLOCK has high current capacity.

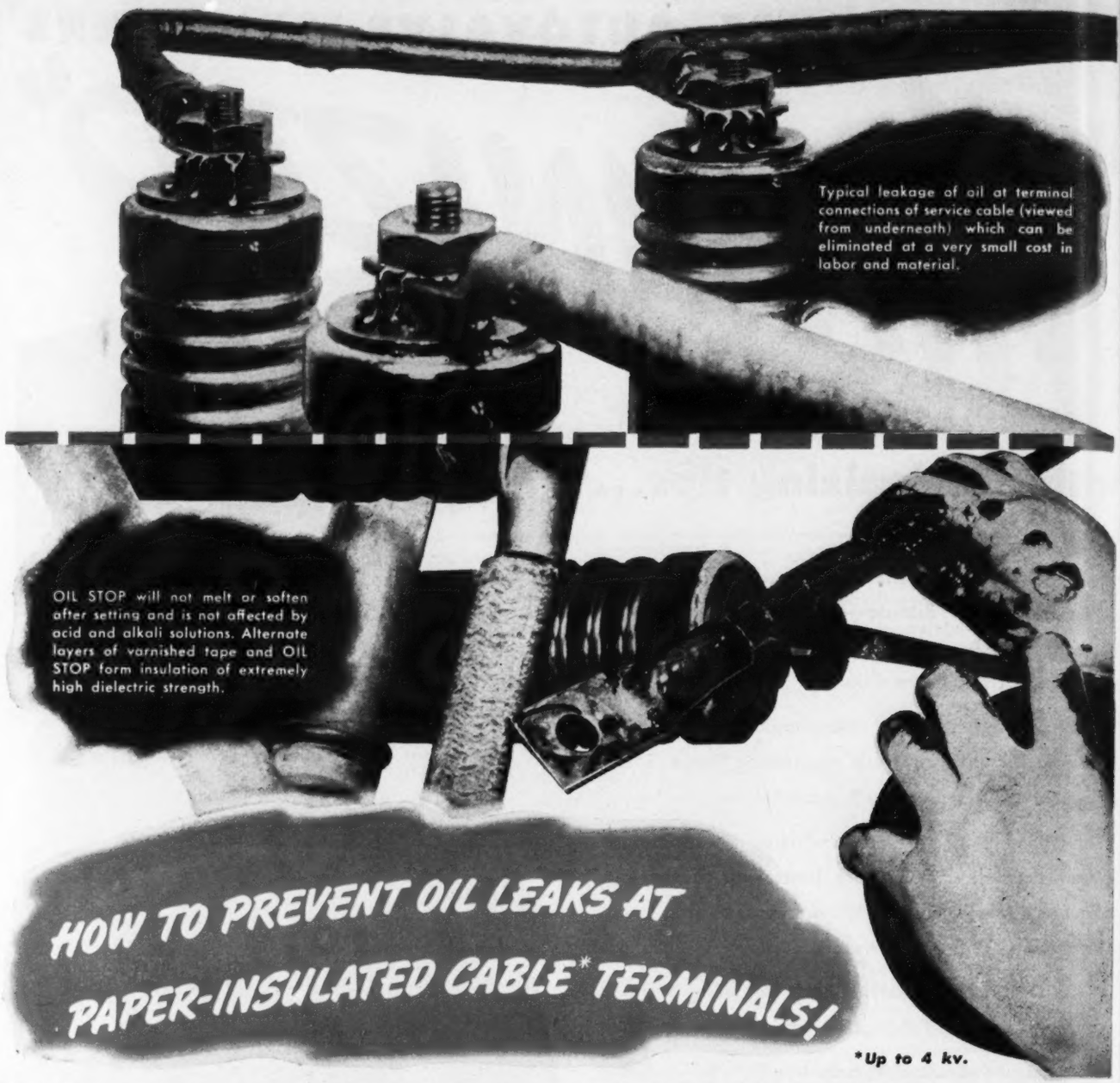
ADEQUATE SEAL and water test assures freedom from moisture.

Westinghouse

PLANTS IN 25 CITIES ... OFFICES EVERYWHERE

WESTINGHOUSE

LIGHTNING ARRESTERS


Typical leakage of oil at terminal connections of service cable (viewed from underneath) which can be eliminated at a very small cost in labor and material.
OIL STOP will not melt or soften after setting and is not affected by acid and alkali solutions. Alternate layers of varnished tape and OIL STOP form insulation of extremely high dielectric strength.

HOW TO PREVENT OIL LEAKS AT PAPER-INSULATED CABLE* TERMINALS!

*Up to 4 kv.

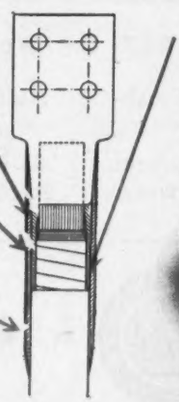
Oil drippings on the floor of customers' vaults are a constant source of complaint. There is always the danger that oil is siphoning from the transformers. This loss of oil reduces the dielectric strength of the cable and insulation strength of the transformer. Such a messy, unworkmanlike condition can easily be overcome through the use of HARVEL OIL STOP and Irvington Black Bias-Cut Varnished Cambric Tape. The combination of these materials forms a durable, infusible insulation that seals against insulating oils.

Here's how the job is done on a lead-covered, paper-insulated cable (distance between termination of lead sheath and the lug is determined by the operating voltage of the cable):

1. Clean grease from conductor. Apply alternate layers of OIL STOP and ½" Bias-Cut Varnished Cambric Tape, smearing OIL STOP well over the entire surface of each layer of tape. Continue until penciled area of cable is covered.

2. Wipe grease from the lug and from the paper insulation of the cable. Apply OIL STOP and 1" Bias-Cut Varnished Cambric Tape as in 1. Build up insulation until it reaches the level of the cable sheath at one end and that of the lug at the other.

3. Clean lead sheath with a suitable solvent (Carbon Tetrachloride is recommended). Apply layers of 1" Bias-Cut Varnished Cambric Tape, one-half lapped, with OIL STOP between each of four layers of tape. Then apply two wraps of tape, one-half lapped, without OIL STOP.



4. For weatherproofing, a coat of OIL STOP should be smeared over the entire surface of the taped area.

For other time-and-money saving uses of HARVEL OIL STOP, send for new illustrated manual describing oil-tight stop joints, splices and other applications. Write Dept. 46.

STANDARD OF THE WORLD

Irvington

VARNISH & INSULATOR CO.

IRVINGTON, N. J., U. S. A.

PLANTS AT: IRVINGTON, N. J. & HAMILTON, ONT., CAN.

Representatives in 20 Principal Cities

1943

FIFTY YEARS

devoted exclusively to the design and manufacture of electrical equipment for circuit protection

★ SHAWMUT IS THE WORD FOR FUSES ★

The Chase-Shawmut Company
Newburyport, Massachusetts

1893

NATIONAL ELECTRIC PRODUCTS
NE
WIRING 6 SYSTEMS
WIRES AND CABLES

NATIONAL ELECTRIC

working

Night and Day

NATIONAL ELECTRIC
PRODUCTS CORPORATION
Pittsburgh, Pa.

The World's Largest Producers of Roughing-In Wiring Materials

Two Hundred Billion

In 1936, after fifty-four years of operation, the total generation of the public supply of electricity passed the 100-billion kilowatt-hour mark. For the twelve months ended with May this year—less than seven years later—the output exceeds 200 billion kilowatt-hours.

This is not just a statistic. It is more than that. It is a reminder that our old benchmarks are gone. We must readjust our sights to new goals.

It took more than half a century and a lot of effort to reach the goal of one hundred billion. The next hundred-billion mark was reached in one-eighth the time, with but a fraction of the toil and trouble.

At the turn of the century this was the industry on which the eyes of youth were focused. The output then was less than two billion kilowatt-hours a year, but the future was great.

What is it that makes great futures? Is it the lure of tremendous percentagewise growth? From 1902 to 1912, the earliest years for which authentic data are available, the increase in output was 360 percent. For a long time it was customary to double every five years.

And now, to make the biggest double of all, we take 6½ years.

That's not bad going at all. The second hundred billion kilowatt-hours in one-eighth the time it took to get the first doesn't seem to indicate an industry that is slipping—doesn't seem to indicate any reduced opportunity for those employed therein—doesn't seem to indicate any dulling of its romance.

Yet the romance has faded, the opportunity is considered less attractive by the individual and the feeling has existed for some time that the industry is slipping.

This new record should cause people to reorient their thinking. If it can do in 6½ years what it took more than half a century previously, what can it do in the years ahead if it but had a goal—a mark to shoot at? Would the inspiration, the opportunity, the romance return if there were something to achieve? There is always something inspirational in looking forward. That is what youth saw when electric service was in its infancy. Are our eyes any duller?

That is what this second hundred-billion kilowatt-hour mark means. It is the promise of opportunity bigger than ever before enjoyed. It is the challenge to maintain the progress. It is the necessity of making bigger plans to reach these larger goals. It is the need for thinking in a bigger way. The chips will be bigger. The play will be faster. The rewards will be larger.

Two hundred billion kilowatt-hours! To some this will be just another statistic, but to those who want a future it is the polestar of opportunity.

Switching Station Modified to Save Copper and Steel

Treated timbers for structures and galvanized conduit for 132-kv. buses substituted in pre-war design in order to avert use of 80 tons of steel and 9 tons of copper

P. H. ADAMS,* Public Service Electric & Gas Company, Newark, N. J.

FORTY TONS of steel and nine tons of copper were saved by substituting timbers and galvanized iron conduit for certain structural members and buses, respectively, in a 55,500-kva., 132/26.4-kv. switching station which had practically been completely designed as a conventional steel-and-copper job before the December 7, 1941, attack on Pearl Harbor. The equipment, steel and most other material had been ordered for this new switching station. By partially redesigning portions of the control and maintenance building another 40 tons of steel was saved.

For several years the substations in the district, which is an important industrial center, had been supplied at 26 kv. jointly by the switching stations to the north and south. A direct 132-kv. circuit from the north also connects that switching station with the switching station to the south (Fig. 1). To control the division of power flow in the parallel transmission systems and the portions of 26-kv. load each station should carry the 26-kv. tie lines were equipped with separately operated quadrature and in-phase regulators located at substations near the new station.

132-Kv. Ring Bus

Initial installation (Fig. 1) at the new station consists of a 132-kv. three-section ring bus with a three bay A-frame line anchorage for two supply circuits and a transformer connection, a 55,500-kva. bank of step-down transformers and a two-section 26-kv. bus with equipment for six local transmission circuits.

The station is supplied by looping

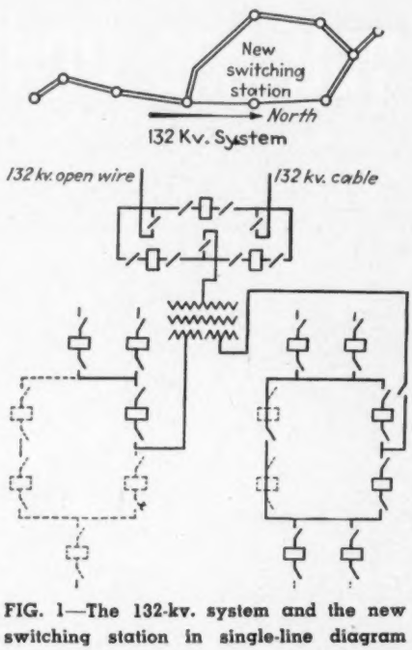


FIG. 1—The 132-kv. system and the new switching station in single-line diagram

the 132-kv. circuit through its high-voltage bus and serves jointly those substations north and south with the two existing switching stations respectively. By the use of two separate low-voltage windings on the single transformer bank and electrically separate 26-kv. buses the operation of transmission relays in the two areas is materially simplified. This electrical separation permits a single ground at the northerly switching station, the principal supply point for that part of the 26-kv. system to the north, and another at the southerly switching station.

The company's standard switching station transformers have two group 15-kv. coils in parallel and, in this case, each group was brought to a separate set of terminal bushings instead of being paralleled inside the tank. This resulted in single-phase transformers with winding ratings of 18,500 - 11,650 / 11,650 - 6,667 - kva., 76.2 - 15.2/15.2 - 11-kv. for 132 - kv. wye, 26.4-kv. double wye, 11-kv. delta operation. The self-cooled 26.4-kv. output of the bank may total 55,500 kva., divided between the two buses in the ratio of two to three. The delta winding is not loaded unless a synchronous condenser is required to supply reactive kilovolt-amperes.

Structures Altered

As originally designed, the high-voltage structures included a simple steel A-frame line anchorage with steel racks on 35-ft. centers for supporting the bus insulators. Disconnecting switches were also to be mounted on steel racks. The 35-ft. spacing of bus supports required 4-in. outside diameter copper tubing with $\frac{1}{8}$-in. wall thickness to prevent objectionable sagging of the bus.

The 26-kv. structure is very much simplified as compared with previous designs. There is no structural connection between the steel support for the bus and that for the cable terminals and line disconnecting switches. Oil circuit breakers are in line in the space between the bus support structure and the line terminal structures. The 26-kv. line terminal structures are also separated from each other, to prevent maintenance men at work on a dead circuit from making accidental contact with an adjacent live one.

Building was designed for steel frame construction and included space for control, transformer repair, oil purification and a work-shop.

*Consulting electrical engineer.

Fabrication of the 132-kv. A-frame was nearing completion and columns for the 26-kv. structure were out and being fabricated when the shortage of steel made it necessary to review all structure designs with the object of reducing the use of critical materials to a minimum. As a result of the study, we recommended and received the War Production Board's approval for the use of steel for the 132-kv. A-frame, the 26-kv. columns and bus support structure and the steel for the transformer repair house section of the building. Timber was substituted for steel in the remainder of the outdoor structures, while in the lower portions of the building reinforced concrete replaced the steel frame design and galvanized iron pipe was substituted for the 4-in. copper tubing originally ordered for the 132-kv. bus.

All timber used for the redesigned structures was long-leaf yellow pine, prefabricated except for drilling and given a Wolman salt preservative treatment of 0.3 lb. per cubic foot. Bolt holes were drilled in a shop on the job because of the inability of the supplier to perform this operation. This necessitated brush-treating the holes with the preservative solution at the site. After erection the treated timber was given a coat of gray stain to match the galvanized steel members and to retard the leaching of the impregnated salts.

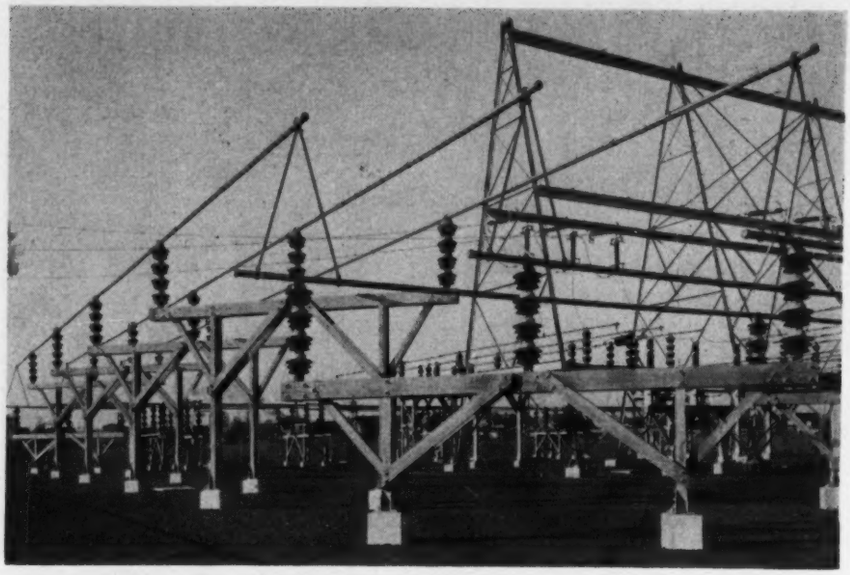


FIG. 3—Wooden racks for 132-kv. bus supports and bus of 3½-in. galvanized iron conduit. Posts are 6x14-in. horizontals 3x12-in. through-bolted to posts and bracing. To provide a phase spacing of 8½ ft. the top members have to be 25 ft. 8½ in. long

Foundation for all the outdoor structures had been completed, so that in changing from steel to wood for the low structures in the 132-kv. yard it was necessary to fit the wooden structures to them, as any change in general layout would have delayed the date of operation. At a number of points the quantity of wood could have been reduced had we made the original design of the structure for timber. In this case, however, the cost of the new foundations would have more than offset any economies in the structures.

Racks for the 132-kv. disconnecting switches are 5 ft. 11⅛ in. high for bus section circuit breaker isolators and 13 ft. 11½ in. high for line or transformer take-off connections.

Steel bases of the disconnecting switches mounted on these racks are connected together with strap iron and each three-pole unit is grounded at two points with stranded copper.

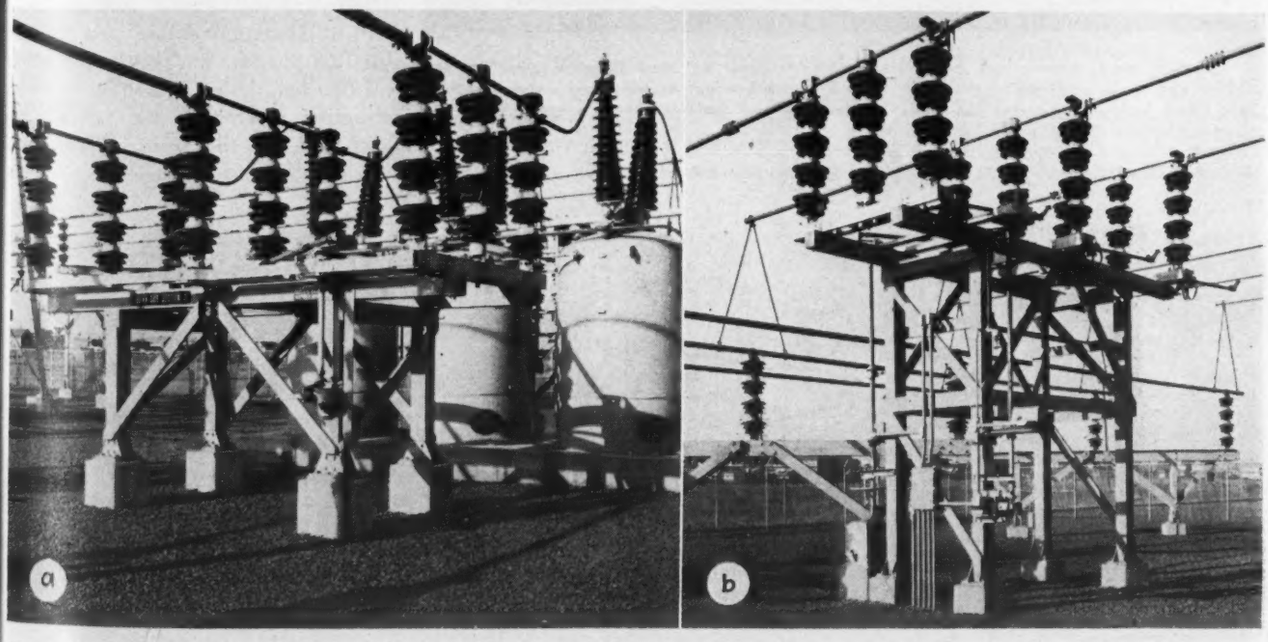
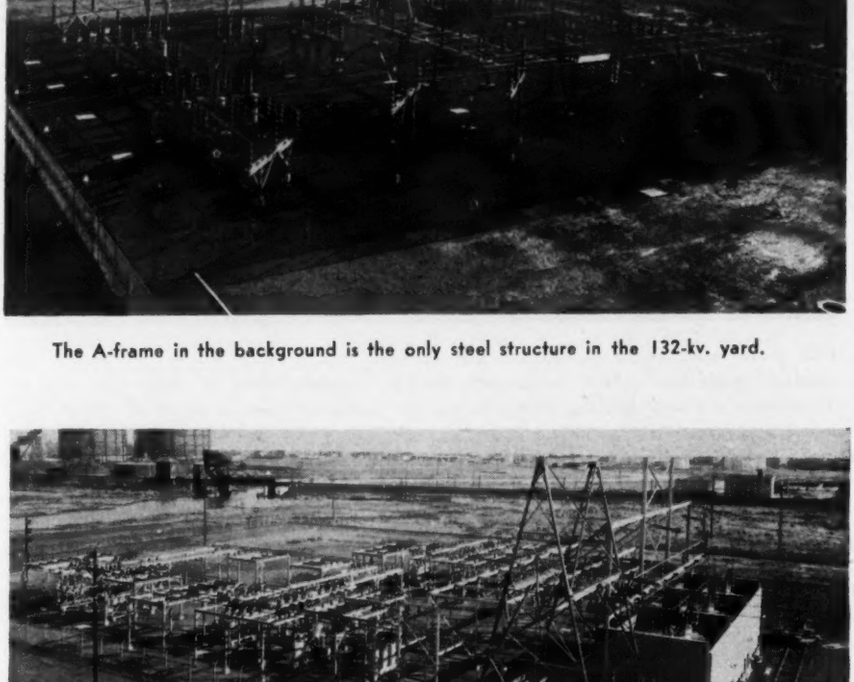


FIG. 2—(a) Isolating disconnecting switch for bus section circuit breaker mounted on wooden structure having 8x8-in. posts, 2x6-in. braces and 2x8-in. horizontals to carry frame of disconnect switches. Frame has 6x6-in. longitudinals doweled to the posts and nailed to angle braces. Strap iron connects bases to ground cable. (b) Line take-off disconnecting switch on wooden rack

The A-frame in the background is the only steel structure in the 132-kv. yard.



26.4-kv. yard, transformer bank, transformer transfer car and terminal structure for 132-kv. cable. In addition to the 12-in. brick firewalls between transformers, there are 8-in. sand-filled hollow-tile protection walls in front of and behind them, with similar walls surrounding the 132-kv. cable terminal.

FIG. 4—General view of 132-kv. (top) and (above) 26.4-kv. yards

Supporting posts for these racks are fitted with steel plate and angle bases similar to those used for steel columns and these are bolted to the posts and to the concrete foundations.

Bus Support Racks

Bus support racks of two heights are also used (Fig. 3), similar in construction to the switch racks. They are placed at an angle to the line of the bus. A similar rack is used for the 132-kv. capacitors which provide potential for relays and synchronizing and are also used as couplers for the carrier-current relays on the open-wire circuit.

Columns for the 26-kv. structure and the framing which supports the main buses had been fabricated before the steel shortage became acute and permission was granted to utilize these members in the final design. Wood members were substituted for all other horizontal steel beams (Fig. 5a and b).

As a result of the substitution of timber in the 132-kv. and 26-kv. structures (Fig. 4) a total of 40 tons of steel was saved.

Galvanized Iron Conduit

Since the 132-kv. bus, which required 4-in. outside diameter copper tubing with $\frac{1}{8}$-in. wall for mechanical strength, carries less than 1,000 amp. maximum load, steel pipe could be used for this bus instead of copper. There was on hand a sufficient surplus of $3\frac{1}{2}$-in. galvanized iron conduit for this purpose and tests were made on two lengths of it using a screwed coupling welded to the conduit on each side of the joint. These tests were made outdoors under conditions

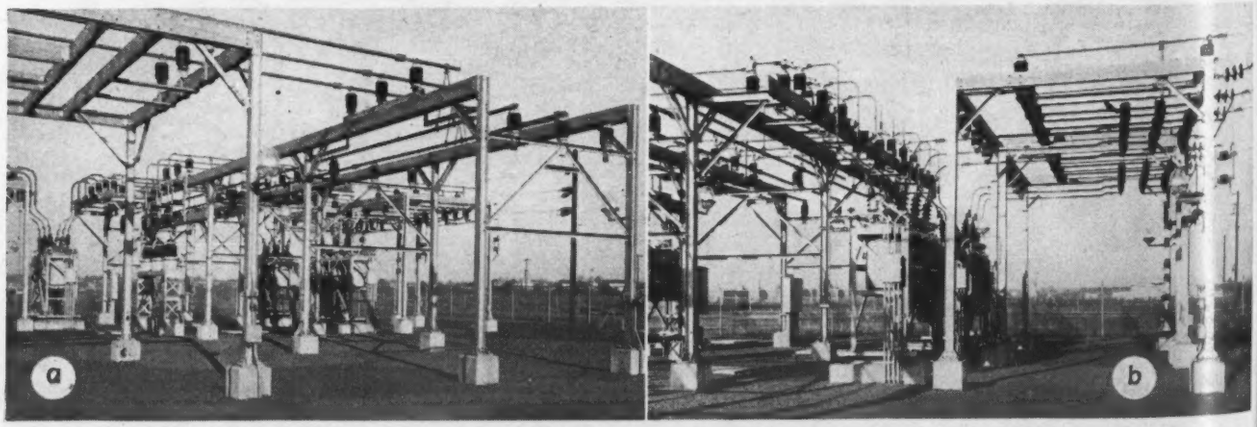


FIG. 5—26.4-kv. structures have wood horizontals on steel columns. (a) View from transformer side of bus. (b) View from feeder side of bus. Each outgoing circuit (at right) has a separate structure.

similar to regular operation with an ambient temperature of 23.8 C. The average temperature rise of the conduit with a load current of 1,020 amp., 60 cycles was less than 60 C., while at 420 amp. the average rise was only 20 C. Since the load on the bus would rarely exceed 400 amp. and since 3½-in. conduit was suitable for use with the bus support clamps and copper fittings for take-off connections and disconnecting switch terminals that had already been delivered, this material was chosen for the 132-kv. bus. A portion of this bus is shown in Fig. 3.

The inverted "V" risers (Fig. 3) between the low and high buses are ¾-in. extra heavy copper tubing with clamp type copper connection fittings. Line and transformer take-off connections (Fig. 2a) are similar to this, except that the large tubing is also copper in these because the current in these connections to a ring bus is usually twice that in the bus.

Total copper saving effected by the substitutions used in this job amounted to approximately 9 tons.

Building Partially Redesigned

No changes were made in the design of the transformer repair section of the control and maintenance building because its height and the weight imposed by the heavy-duty crane when used for assembling the transformers would have required concrete columns of excessive size. The control, oil handling and shop sections, however, were redesigned for reinforced concrete type of construction in place of the steel frame originally proposed.

This type of construction is not new, of course, but for a two-story control room it is not particularly desirable, as it introduces many objectionable features that are not present in a steel frame structure. Its adoption, however, did effect a saving of an additional 40 tons of steel, thus bringing the total saving in steel at this station to 80 tons.

In spite of many delays entailed in the changes in design and other difficulties encountered because of the conditions arising from the war, the 132-kv. lines were connected to the station buses on October 3 in accordance with the schedule. Regular service from the station began October 12, when the first two 26-kv. circuits were connected to the station.

Set Industry War Bond Record

Wisconsin Power & Light employees set record for utilities with 15.3 percent of payroll allotted to War Bonds—Management, labor and employees unite in all-out co-operative effort

HOW Wisconsin Power & Light Company, an "average" organization as utilities go, came to be the No. 1 company of the industry in the Treasury Department's War Bond drive is not a spectacular story. Rather it is a story of the quiet, efficient teamwork that has marked the utility industry's participation in the whole war effort since long before Pearl Harbor.

Credit for achieving the record-breaking 15.3 percent of payroll allotted to War Bonds must be equally divided among management, labor and personnel of the company as a whole. Management provided a well-organized plan for reaching all employees with the War Bond story. Labor-group leaders provided a novel "bond-bonus" idea that carried the program over the top and on to a record. And, finally, the company employees, through their unselfish and enthusiastic acceptance, insured the complete success of the plan.

Had any one of these three groups failed in its responsibility or contributed less than whole-hearted support mediocre performance would have followed. As it was, mutual co-operation provided the extra spark that turned mediocrity into record-breaking success.

Management Had a Plan

Prime requisite for the success of any campaign is a well-organized plan. This was supplied by management. To it they contributed enthusiastic support backed up by vigorous execution. Nothing was left to chance.

Plans and objectives of the payroll allotment plan were carefully explained in a booklet. But these were not distributed in the usual manner. "We refused to proceed on the assumption that people would fully understand the plan or give it their complete support, after merely reading it," President Grover C. Neff explained. This healthy skepticism was the keystone of management's campaign plan.

First, Mr. Neff called together all officers of the company, department heads and division managers. To them, word for word, he read the prepared booklet. The meeting was not adjourned until all questions were answered and every one understood the plan and appreciated the need for buying War Bonds.

Group Meetings

Company executives who attended the meeting were instructed to return to their domains, call their key people together and read the plan to them until satisfied that they in turn understood it. Thus the details of the plan were spread through the organization in group meetings, each small enough to permit full and free discussion.

Experience with these meetings proved the wisdom of the course. There were questions, doubts and fears expressed. But by resolving them all at the fountainhead, as they arose, the campaign got off to a good start.

It would be false to state that the campaign ran smoothly on to its crowning success. As some divisions and departments did better than oth-

ers, the ideas of the successful groups were used in those with poorer showing, to better the general average.

The campaign lagged after a time, but was revived following a War Bond rally in Chicago which management and labor representatives attended, and a series of follow-up meetings were conducted in the same manner as those that introduced the plan. Renewed enthusiasm resulted

TYPICAL GROUP in Beaver Dam division hears the War Bond campaign explained for first time by Manager A. D. Johnson. These key people carried the plan to other groups like this, in which all questions are fully answered

and payroll deductions for War Bonds took a further upward surge, until by the end of August, 1942, they had risen until about 9 percent of total payroll had been pledged for War Bonds.

Labor Has an Idea

In midsummer the two labor unions, representing electrical and bus company employees, requested a pay increase, based on the "Little Steel" formula. While these negotiations were still unsettled the U. S. Treasury Department invited representatives of management and labor groups to attend the Chicago War Bond rally already mentioned, the program of which had a profound effect on both the labor and management delegates from the Wisconsin company, and indirectly on the future success of their campaign, particularly a 17-minute sound film, "The Last Message of Corregidor." "If any good, red-blooded American citizen can sit and listen to that message and not realize that he has to buy War Bonds there is something wrong with him," said Herbert A. Harpold, business agent of the Brotherhood of Electrical Workers, Local B-965, in describing the program afterward.

Returning from the rally with a renewed conviction of the need for increasing War Bond purchases, the executive committee of Local B-965, I.B.E.W., A. L. Babcock, president, and Mr. Harpold, business agent, brought to the wage negotiations the suggestion that the wage increase under discussion be made in the form of War Bonds. By issuing a $50 bond to each employee every four months the wage level would be increased 6 percent, bringing it into conformity with the "Little Steel" formula and the scale of other utilities in the state.

Management granted the increase on this basis and extended it to all employees after acceptance by the second union, the Amalgamated Association of Street, Electric Railway and Motor Coach Employees of America, through Frank P. Miller, president, and Frank Seager, business agent.

This novel "bond-bonus" plan brought the total payroll allotment of company employees for War Bonds to the high point of 15.3 percent. In addition it made it possible for all company employees to fulfill their patriotic obligation to a greater extent than formerly without an "out-of-pocket" outlay of cash. As a so-called "Temporary Emergency Adjusted Compensation Bonus," it was a temporary adjustment in the form of a bonus, to take care of increases in living costs in conformity with the established "Little Steel" formula. It went into effect September 1, 1942.

Employee Participation

Thanks to the thorough presentation of the plan to small employee groups, response to the payroll allotment plan was generous and unstinting throughout.

Scarcely had the plan been announced, and before other divisions could gather themselves to compete seriously, when A. D. Johnson, division manager at Beaver Dam, Wisconsin, let it be known quite casually that not only was every member of his group "signed up," but they had all allotted 10 percent or more of salary to War Bonds. And this before serious campaigning for 10 percent allotment was undertaken.

In all fairness this phenomenal accomplishment was a surprise to Manager Johnson, who was also Dodge County War Bond Committee chairman. It came about because M. C. Hollenbeck, operating superintendent, and Grace Le Fleur, chief clerk at Beaver Dam, felt that Mr. Johnson's own company division should set an example if he was to be County Bond Committee chairman. On the "quiet" they set about signing up every division employee for 10 percent and presented the cards to Johnson as a surprise "gift." This in just one division!

One Case

There is hardly a division or department of the company that hasn't a stirring story to tell. Many concerned those whose subscriptions represented very real hardship and sacrifice. One concerns an employee who turned in a card asking for a 20 percent deduction. Questioned about the wisdom of giving double the suggested allotment, he said to his "chief," "You told us to give till it hurts—This hurts."

Electrical Application of New Thermoplastics

Merits and limitations for electrical purposes of plastics which harden and soften with temperature — War developments promise new products from which further to choose for ideal combinations of characteristics

T. S. CARSWELL and TURNER ALFREY, Jr.,† Monsanto Chemical Company, Springfield, Mass.*

BY DEFINITION, a thermoplastic material is one which softens when heated and hardens when cooled, and which does so reversibly. In practice, the term is generally understood to apply only to organic materials which soften sufficiently to become moldable at temperatures not exceeding about 500 F.

Advantages of Thermoplastics

As a class, thermoplastics possess the following general advantages:

1. They may be fabricated to finished form by a wide variety of methods, each of which permits considerable latitude in conditions. These fabricating processes include compression molding, injection molding, extrusion molding, blowing, swaging, drawing, casting (either from solution or from incompletely polymerized sirups), laminating, punching, shearing, and the usual machining operations.

2. They are easily molded by fast, economical processes, to give a complete finished part, containing inserts if desired, and requiring no painting or other finishing since color and surface are integral.

3. Sprues, runners and rejected moldings may be salvaged by grinding and remolding, since the molding process is completely reversible.

Many members of the group also possess special individual advantages, such as toughness, superb electrical characteristics, unusual glass-like clarity, elasticity, etc.

Disadvantages of Thermoplastics

Thermoplastics in general suffer from the following disadvantages:

1. Since they soften when heated, thermoplastics cannot be used in situations where high temperatures are encountered. Generally speaking, thermoplastic parts will not withstand stresses at temperatures above 100 C. (212 F.) and for the most materials the maximum safe operating temperature is considerably lower. This is the most important obstacle to the more widespread use of thermoplastics in electronic apparatus.

2. In common with many other engineering materials, thermoplastics undergo creep (sometimes known as cold flow), even at ordinary temperatures and at stresses far below short-time test strength values.

Many members of the thermoplastic group may also possess individual disadvantages such as high water absorption, poor weather and dimensional stability, loss of plasticizer on aging, brittleness at low temperatures, etc.

Electrical Applications

In the electric appliance field thermoplastics have long been utilized for both structural and non-structural applications.

In the generation, transmission and utilization of electricity thermoplastics have also found wide use. Thermoplastic parts are familiar components of apparatus in the fields of power and light, telephone and telegraph and radio and UHF. Typical uses include wire and cable insulation, battery cases and separator plates, coil forms, tube bases, stand-off insulators, hand-sets, instrument cases and covers, dials, nameplates, control knobs and dials, housings and cases, jack plugs and receptacles, wrapping tape, tool handles, switches and plates, and instrument panels.

Materials Now in Use

Thermoplastic materials for which proved applications exist are listed below, along with their principal uses, advantages and limitations. The physical and electrical characteristics of these materials are summarized in Table I and are compared, visually, in Table II.

A. *Cellulose Derivatives:*

1. Cellulose Acetate (Fibestos, Tenite I, Plastacele, Lumarith, Nixonite)—Housing, knobs, controls, transparent coverings, winding tape, handsets. Excellent moldability and good toughness; characteristics may be varied over wide range by varying type and amount of plasticizer. Moderately high water absorption and volatility of plasticizers cause dimensional change on aging. Weather resistance only fair. Becomes brittle at low temperatures. Not usable above 100 C., and most types not aboye 60 C. if stressed.

2. Cellulose Acetobutyrate (Tenite II)—Generally similar to cellulose acetate, but more water resistant and dimensionally stable; weathers better.

3. Ethyl Cellulose (Ethocel, Ethyl Rub-

*Director of Research. †Research Chemist.
Adapted from informal paper presented at recent A.I.E.E. conference on plastics at Pittsfield.

This is the second in a series of articles about plastics as the electrical engineer needs to know about their chemistry, their properties and their practicable applications. The first was "Chemical Background for Electrical Properties of Plastics," in the April 17 issue. This one gives usable facts about thermoplastics. Articles planned for subsequent issues will treat the fields of thermosetting plastics, of laminated plastics, of application which industrial and power system electrical engineers envision for plastics, etc.—EDITORS.

Table I—Thermoplastic Materials Used in Electrical Engineering

Data assembled from published information; values may vary depending upon formulation or special conditions of manufacture. Costs represent best commercial information at time of writing, but may be subject to change at any time. For visual comparison the properties are shown in ranges in Table II.

Material	Electrical Properties			Physical Properties			Cost, Dollars		Molding Methods Applicable*
	Dielectric Constant	Power Factor	Dielectric Strength, V/mil.	Specific Gravity	Water Absorption, %	Distortion Temp., °C.	Per Pound	Per 100 Cubic Inches	
Cellulose Acetate	3.5–6.4	0.01–0.06	290–800	1.27–1.37	2.0–4.7	45–100	$0.465	$2.19	I, C, E, F
Cellulose Acetobutyrate	3.5–6.4	0.01–0.06	250–400	1.14–1.22	1.6–2.1	45–100	0.515	2.23	I, C, E, F
Ethyl Cellulose	2.5–3.5	0.005–0.025	400–700	1.12–1.15	1.0–2.0	48–93	0.56	2.32	I, C, E, F
Cellulose Nitrate	6.7–7.3	0.06–0.15	600	1.35–1.40	0.6–2.0	43–65	1.16 (Sheets)	5.65	E, F
Polystyrene	2.5–2.6	0.0001–0.0003	500–700	1.05–1.07	0.05	76–78	0.32	1.21	I, C, E
Polymethylmethacrylate	3.0–3.5	0.04–0.7	500	1.16–1.20	0.4–0.5	52.70	0.85	3.68	I, C, E
Polyvinyl chloride	5.0–6.0	0.10–0.16	600–2,000	1.2–1.6	0.1–1.3	60–85	0.48	2.43	E
Polyvinyl Chloride-Acetate	3.2–7.5	0.01–0.12	300–400	1.34–1.36	0.05–0.15	60–65	0.46	2.24	I, C, E, F
Polyvinyl Acetate	3–11	0 014	400–800	1.19	<2.0	50–60	0.45	1.93	C, E
Polyvinyl Formal	3.3–3.7	0.01	1,200–1,600	1.2–1.3	0.6–1.3	75–85	0.80–0.90	3.84	I, C, E
Polyvinyl Acetal	3	0.007	1,000	1.16	2	60–75	0.61–0.70	2.75	I, C, E
Polyvinyl Butyral	3.6–6.1	0 007–0.05	360–420	1.07–1.20	0.5–2.0	50–60	1.10	4.52	I, C, E
Polyvinyl Alcohol	.....	.....	.....	1.29	Soluble	.....	0.60	2.80	E, C
Polyvinylidene Chloride	3.0–5.0	0.03–0 15	500	1.68–1.75	<0.1	60–75	0.53	4.22	I, C, E, F
Polychloroprene	7.5	0.03	400–900	1.24	2.5	.....	0.65	2.91	C, E
Ethylene Polysulfide	7.5	0.55	500	1.54–1.55	0.04	.....	0.49	2.72	C, E
Pine Tar Resins	2.8–3.3	0.026	300	1.10	0.32	45–65	0.04	.16	C
Aniline Formaldehyde	3.7	0.004	600–700	1.22–1.25	0.01–0.68	110	2.00 (Sheets)	8.92	C

* I—Injection; C— Compression; E—Extrusion; F—Forming and drawing.

ber)—Generally similar to cellulose acetate and acetobutyrate. Fairly good water resistance and dimensional stability, but weather resistance is only fair. Some varieties have fairly good toughness at low temperatures. Used in extruded, flexible wire-covering.

4. Cellulose Nitrate (Celluloid, Nitron, Pyralin, Nixonoid)—Tough and dimensionally stable, but highly inflammable and weathers poorly. Used in tool handles, drawing instruments, scales and dial faces, battery separators.

B. *Vinyl-Type Polymers:*

1. Polystyrene (Styron, Lustron, Loalin)—Exceptionally good electrical characteristics, moisture resistance, clarity and dimensional stability. Low ductility, however, limits toughness; maximum operating temperature is about 70 C., or lower if subjected to appreciable stress. Widely used in radio apparatus, refrigerator parts, battery cases and lighting fixtures.

2. Polymethylmethacrylate (Plexiglas, Lucite)—Generally similar to polystyrene in appearance and mechanical properties, but inferior electrically. Slightly better clarity and weather resistance. Used in dial and gage covers, housing, reflectors and signal lens.

3. Polyvinyl Chloride (Koroseal)—Good electrical characteristics and practically non-inflammable. May be varied from hard rigid solid to soft, flexible elastomer by selection of plasticizers. Thermal stability and clarity are only fair. Widely used for wire and cable covering and for wrapping foils.

4. Polyvinyl Chloride-Acetate (Vinylite)—Generally similar to polyvinyl chloride, but has better clarity, stability and moldability. Used for wire and cable covering, and for molded parts.

5. Polyvinyl Acetate (Gelva)—A soft resin with a relatively narrow temperature range between brittle point and tacky point. Principal use is in adhesives.

6. Polyvinyl Formal (Formvar).

7. Polyvinyl Acetal (Alvar).

8. Polyvinyl Butyral (Butvar, Saflex, Butacite).

These three are tough, strong plastics, whose properties may be varied by plasticization. Water resistance is only fairly good and maximum usable temperature is fairly low (45-70 C.). The formal is widely used as an ingredient of a superior wire-coating enamel and has been used to some extent for molded parts. The butyral has been used chiefly for the interlayer in high-test safety glass, but has found wartime uses as a replacement for rubber in waterproof clothing and fabrics.

9. Polyvinyl Alcohol (PVA, Resistoflex)—This material has excellent oil resistance, but is sensitive to moisture. It has found few electrical applications.

10. Polyvinylidene Chloride (Saran)—Resembles polyvinyl chloride in some respects, but may be produced in the form of oriented, crystalline filaments or moldings of high strength. Used in flexible tubing, moisture-proof wrapping foil, etc.

11. Polychloroprene (Neoprene)—One of the best of the synthetic rubbers, this material has excellent resistance to petroleum hydrocarbons, to heat and oxidation, and is widely used where these properties, lacking in natural rubber, are important. In electrical characteristics, it resembles natural rubber.

12. Ethylene Polysulfide (Thiokol)—This also is a synthetic rubber with good resistance to solvents. It is used for covering wire and cable used in locations where contact with solvents, which would ruin ordinary rubber, is expected.

C. *Pine Tar Resins (Vinsol):*

These are dark colored, brittle resins with little mechanical strength. They have good electrical properties and good resistance to oil and water. Their principal uses are in potting transformers, in cold moldings, and as a cheap adulterant or extender in other plastics.

D. *Aniline-Formaldehyde Resins (Dielectene, Cibanite):*

These resemble phenolic resins in many respects but are really thermoplastic materials with very high softening points. They are restricted with respect to moldability, but have good electrical properties and mechanical strength.

Post-War Probabilities

Many materials adapted for war uses will undoubtedly find applica-

Table II—Comparative Properties of Thermoplastics

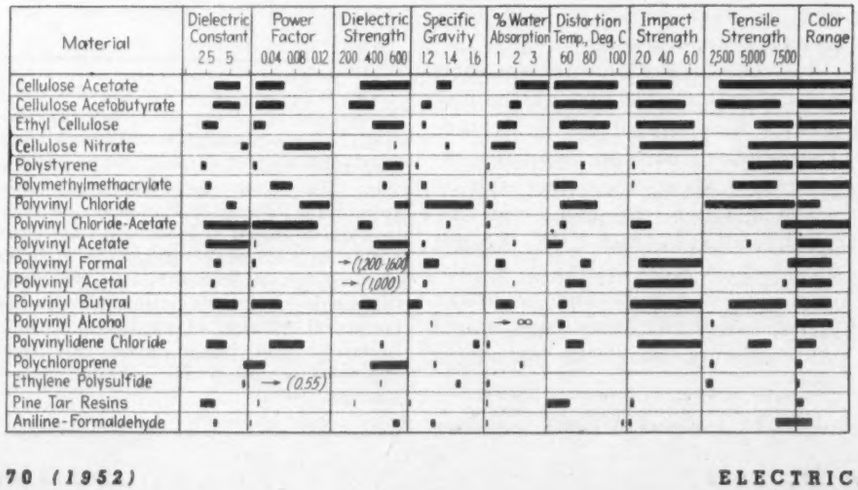


Table III—Thermoplastic Materials Probably Available Post-War

Data assembled from published information, but may vary depending upon formulation or special conditions of manufacture. Many of the materials listed are under allocation and are unavailable for most uses at present. Costs shown represent best available information, but may change greatly in the post-war period.

Material	Electrical Properties			Physical Properties			Probable Cost, Dollars		Molding* Methods Applicable	Forms† Available (Probable)
	Dielectric Constant	Power Factor	Dielectric Strength V./mil.	Specific Gravity	% Water Absorption	Distortion Temp. °C.	Per Pound	Per 100 cubic in.		
Cellulose Triacetate	3.0–4.0	0.009–0.037	600–1500	1.26	0.5–1.5	60–90	1.00 (Film)	4.55	F, E	F, MF
Polyamides (Nylon)	3.2	0.01–0.02	800	1.14	1.1–3.0	70–100	2.10	8.65	I, C, E	F, M, MF
Polyethylene	2.4	0.0005	600	0.95–1.0	nil.	softens 100	0.35–0.50	1.53	I, C, E	M, F
Polyisobutylene	2.2	0.0005	500	0.95–1.0	nil.	.....	0.25–0.35	1.08	I, C, E	M, F
Butadiene-Styrene (Buna S)	2.9–4.4	0.017	.....	0.94	.....	.....	0.32–0.40	1.22	C, E	M, F
Butadiene-Acrylonitrile (Buna N)	15.	.....	.....	0.96	.....	.....	0.40–0.65	1.82	C, E	M, F
Benzyl Cellulose	3.4	0.005–0.024	2200	1.3	0.4–0.8	45–60	1.00–2.50	8.20	I, C, E, F	M, F, S, R
Styrene-Chlorodiphenyl (Styramic)	2.55	0.0004	500–800	1.36	0.046	84.5–86.5	0.68	3.34	I, C, E	M, S, R[1]
Styrene, modified chemically	2.62	<.0002	500–800	1.3–1.4	0.02–0.04	110–120	1.00	4.87	I, C, E, F	M, S, R, C
Styrene, cross-linked	2.6	0.0004	500–800	1.06–1.10	0.04–0.06	75–85	0.50	1.95	C (?)	C
Organo-Silicon Resins	3.7	0.008	.....	1.19	.....	Ca. 200	?	?	?	C, S(?),R (?)

* I—Injection; C—Compression; E—Extrusion; F—Forming and drawing.
† F—Films and foils; S—Sheets; R—Rods and tubes; M—Molding granules; MF—Monofilaments; C—cast shapes.

tion in the electrical field when peacetime production is resumed. While exigencies of the moment naturally prevent free discussion, the following post-war developments seem probable.

Cellulose triacetate films and foils, which have been used widely in Germany and Russia for insulating wires and cables, will probably become available in useful form.

Polyamides (Nylon) will probably be adapted for injection molding, and the use of Nylon monofilaments will probably increase.

Polyethylene, which is used extensively in England for flexible cable coverings, sleeving, and radio parts, will probably become available on a commercial scale in America and should find many electrical applications.

Polyisobutylene, which is somewhat more rubbery than polyethylene and has excellent low-loss properties, will probably be manufactured in this country, also.

Large amounts of the copolymers of butadiene with styrene (Buna S) or acrylonitrile (Buna N) will be available, and it seems likely that these materials may replace rubber in many electrical applications and do a better job.

Benzyl cellulose, an old material, may possibly achieve commercial production, although from an economic viewpoint this seems questionable.

The high-strength plastics, based on paper, glass fiber, special fabrics or special fibers, which are developing rapidly for war uses, will probably be useful for constructing large electrical apparatus and appliances.

Modified polystyrenes, such as combinations with certain chlorinated diphenyls (Styramic), which are useful for radio components, may be used in civilian electronic equipment. Cross-linked and chemically modified polystyrenes may also find use in these applications.

Organo-silicon resins are under active development in several laboratories at the present time, and some of these may soon be available commercially. These materials, which range from thermoplastics through intermediate stages into thermosetting resins, depending upon the chemical configuration, are distinguished by excellent heat stability and good electrical properties. Their cost, however, is likely to remain high for some time.

The properties of some of these materials are briefed in Table III.

Future Developments

Tremendous growth of applications for short-wave and microwave technics in this war has emphasized and expanded the need for a moldable plastic with high softening point, extremely low dielectric-loss characteristics and reasonably good mechanical strength. Polystyrene, which most nearly approaches these requirements, has too low a softening point and most attempts at modification have either failed to produce sufficient improvement or have resulted in inferior electrical properties. However, modifications of the styrene molecule itself, or copolymerization with a second, bifunctional monomer to produce a cross-linked structure of greater thermal stability, show considerable promise, and it seems probable that such materials will find application in useful and important components of electronic apparatus, as well as in other electrical equipment, in the post-war era, and perhaps sooner.

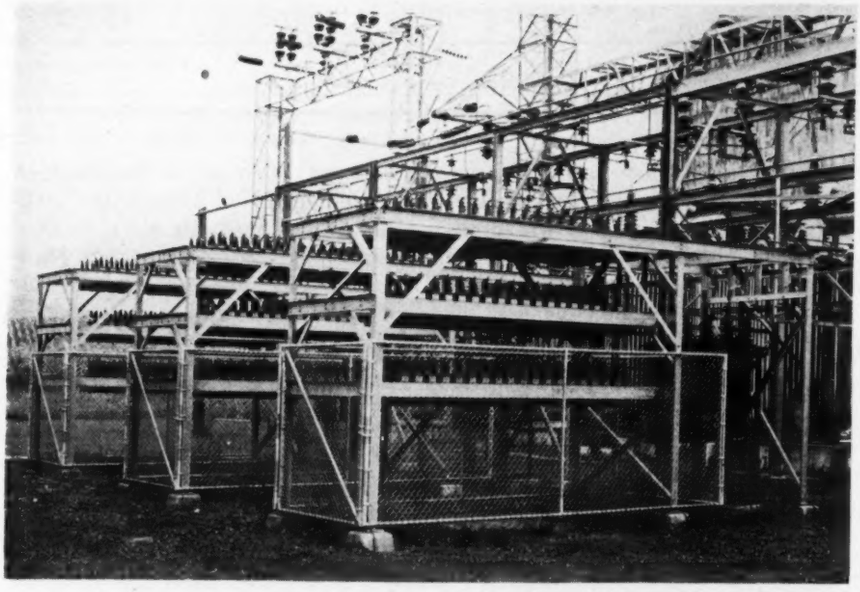
Similar technics may be expected to overcome some of the practical objections to other thermoplastic materials, and should result in new products of greater strength and stability. Creep and low thermal resistance may also be improved, where clarity is not essential, by reinforcement with high-strength fibers and fabrics, and the extension of these technics into the electrical field may be expected. Strong housings, cabinets, and, possibly even entire refrigerators, may be made from such materials. Thermosetting resins will, of course, be used in this type of structure, also.

Modification of thermoplastics by cross-linking produces a material which is essentially thermoset. In many cases it is difficult to decide whether a new plastic should be classified as thermoplastic or thermosetting in nature.

Capacitor of 5,000 Kva. for Substation Regulation

Economical reactive supply and voltage correction from unfused, liberally spaced, breaker-controlled, delta-connected, 2,400-volt units at substation — Surges minimized

W. W. PERRY and D. M. UMPHREY†*



THREE 1,667-kva. sections of outdoor hanger type, two-bushing capacitors at substation

A 5,000-KVA. capacitor bank has been installed at the 12,500-kva. Bath substation of the New York State Gas & Electric Corporation to correct a general condition of low voltage in the area near the proposed capacitor bank location, to relieve transmission lines of as much reactive current as economically possible and to relieve the existing generating capacity of an appreciable amount of reactive kva. load. The choice of the capacitor bank in preference to distributed capacitors or a synchronous condenser was made on the basis of cost as well as operating flexibility.

Each of the three 1,667-kva. sections is composed of 111 "Inerteen"-impregnated, 15-kva., 2,400-volt, outdoor hanger type, two-bushing capacitor units connected in delta. Use of individual unit fuses or fused groups of units was abandoned for the purpose of low cost and simplicity. The hazard of damaging several units as a result of a fault in one unit was reduced by rigid mounting of the units, liberal spacing, flexible loop connection to porcelain terminals and rapid isolation of faulted sections.

New York State Electric & Gas Corporation supplies electric service for approximately 40 percent of the total area of the state, the major portion being in the central counties along the Pennsylvania border and north. The principal load centers are a large number of rather small industrial towns distributed uniformly throughout the region. All of which presents a rather complex transmission problem, especially from a voltage regulation standpoint.

Many types of equipment are available for regulating voltage on radial or simple loop systems, but this is not the case with a network transmission system such as the one in use here, as voltage correction must be applied to perhaps an entire section. To provide this correction by means of any scheme other than capacitive kva. requires a number of costly and rather inflexible voltage regulators installed at or near the boundaries of the low-voltage region. Also, such a solution to the voltage problem tends to increase transmission losses and does not correct the voltage gradient through the system due to the flow of reactive kva., nor does it relieve the remainder of the transmission system and generating capacity of reactive kva.

Studied on Network Calculator

The need for extensive voltage correction in the vicinity of the towns of Bath and Corning, N. Y., became evident from field studies made by engineers of the New York State Electric & Gas Corporation. With the aid of a network calculator study of the system, it was decided to install either a synchronous condenser or capacitor bank at Bath and to install a similar unit at Corning at a later date.

In applying capacitors for voltage correction, it is often desirable to distribute them on distribution feeders rather than to combine their capacity at one point. The beneficial effect of capacitors applied in this manner is lower feeder energy loss

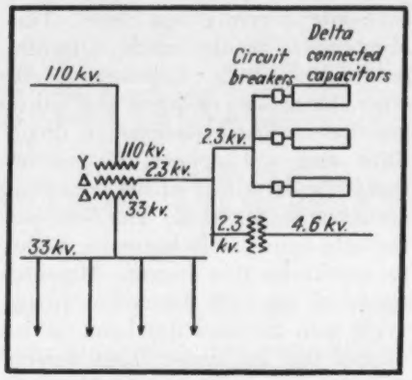
*Electrical Engineer, New York State Electric & Gas Corporation, Binghamton.
† Central Station Engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

and better voltage control. In this instance, however, voltage regulation on a properly located substation bus was the primary problem and it was necessary that any means used should be controlled manually and possibly automatically. Such control over distributed capacitors is complex and costly as compared to the control of capacitors located at one point. As a result the distributed capacitor application was not considered further.

Comparative Costs

The initial cost of a synchronous condenser was found to be slightly less than an equivalent capacitor, but the higher maintenance and operating costs of the rotating equipment offset the first cost advantage of the condenser. Also the full load loss of the synchronous condenser was about 300 kw., many times that of the 17½-kw. loss of the capacitor and could very definitely be evaluated, since a considerable amount of power is purchased by this utility on a demand basis during peak-load periods. In considering the synchronous condenser no credit was given for lagging reactive kva. capacity since there appeared to be no demand for it.

Another definite advantage favoring the capacitor bank was the use of standard 15-kva. hanger type units suitable for future pole line mounting on distribution circuits, if desired. This advantage was not evaluated, but there is little doubt that the useful life of the investment will be prolonged by the added flexibility, especially if future changes in the system eliminate the necessity of this bank.



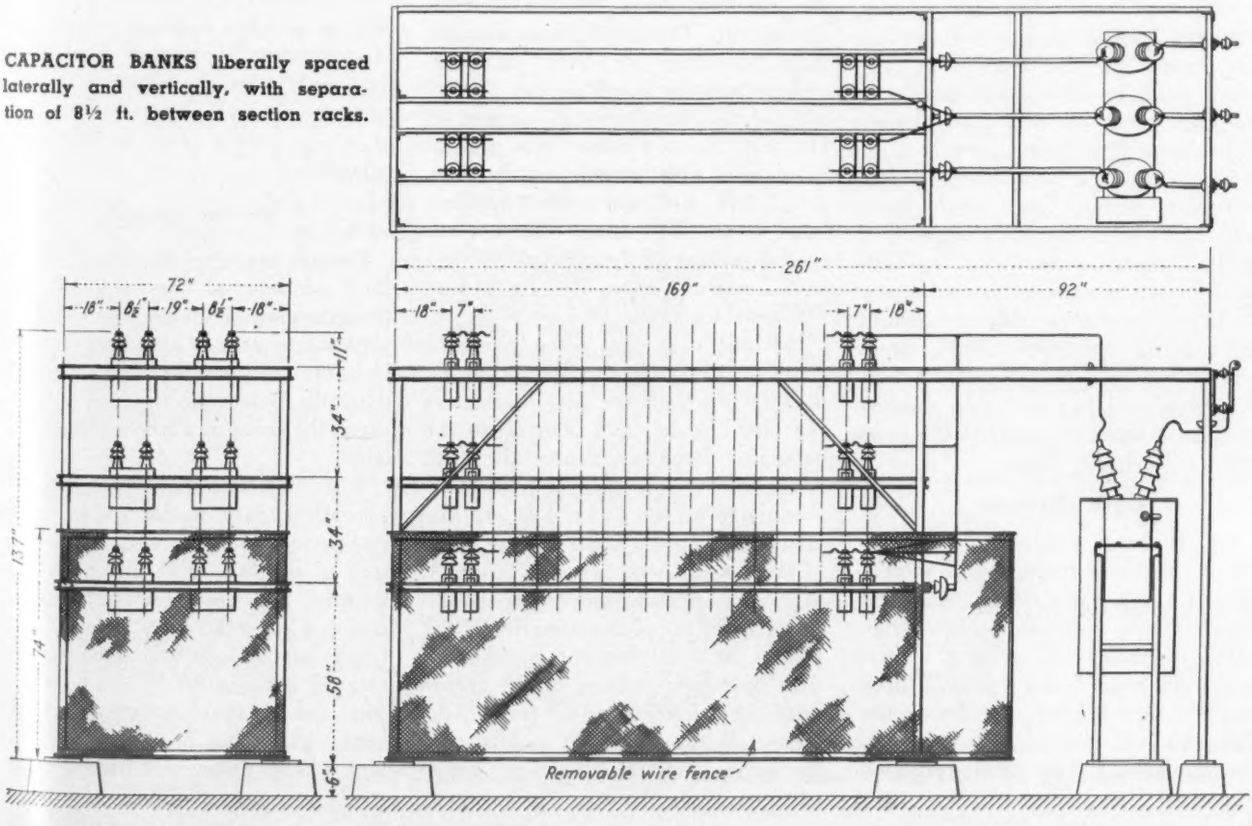
CAPACITORS (delta-connected) connected to 2.3-kv. winding of three-winding 110/33/2.3-kv., 12,500-kva. transformer bank

After it was determined that a static capacitor was the most economical solution, other problems arose in connection with the rather large capacitor bank. It was, of course, not possible to switch the entire bank at once, since doing so would cause a 6 percent change in voltage on the substation bus. One-third of this change was considered permissible and allowed the unit to be divided into three 1,667-kva. sections, each controlled by means of a 15-kv., 600-amp., 250,000-kva. electrically operated circuit breaker.

Surge Current Protection

Surge current drawn by a capacitor at the instant when it is connected with a potential source is generally quite high and may be sufficient to damage circuit-breaker contacts. The heavy surge is charging current which must flow before a voltage can appear between the capacitor terminals. In case an energized capacitor is paralleled with a non-energized capacitor at an instant when the voltage between the terminals of the energized unit is maximum, the reactance and resistance of the two capacitors and the connecting leads form the only impedance to the flow of current between the units. As this impedance can be as low as 0.0005 to 0.002 ohm on a 60-cycle basis, the current may reach 10,000 to 50,000 amp. for a short period of time be-

CAPACITOR BANKS liberally spaced laterally and vertically, with separation of 8½ ft. between section racks.



fore its oscillations are damped out by the circuit resistance. Frequency of the oscillations is controlled by the natural frequency of the circuit and is very high (several thousand cycles per second) in most cases.

Breaker Capacity

It is necessary to reduce the surge or inrush current to a value which the breakers can close against two or more times per day without excessive contact burning. In this case it was considered desirable to limit the inrush current to approximately 8,000 amp. This can be accomplished by inserting a section of iron conductor in the bus to act as a current limiting resistor, but I^2R loss due to normal load current becomes excessive for a bank of this size. A better method consists of increasing the inductance of the circuits between capacitors to 0.03 millihenry by inserting reactors in the leads, or by increasing the spacing and the length of the leads to such an extent that the necessary inductance will become a part of the circuit. The latter method was used in this case and an examination of the breaker contacts after a large number of operations has revealed very little deterioration due to surge currents.

The capacitor units were connected in delta to take advantage of the standard 2,400-volt units. A grounded star connection was avoided to prevent possible complications from third harmonic currents and voltages which could have been aggravated by capacitors in such a connection. Also, a system ground fault would have subjected two-thirds of the capacitors to 73 percent overvoltage. The failure of a unit in a star-connected group of three capacitors with or without the neutral grounded could cause line-to-line voltage to appear across the remaining two and thus destroy them in a short time unless the units were individually fused.

Fifth Harmonic

Reactance of a capacitor varies inversely with the frequency of the circuit to which it is applied, permitting rather severe currents if higher harmonic voltages are present. Third harmonic voltage on a balanced three-phase system is a zero-sequence quantity and will not appear across the terminals of a delta or ungrounded-star capacitor bank, so that no third harmonic currents will flow. This also applies to the ninth, fifteenth, twenty-first, etc., harmonics. All other harmonic voltages are either positive- or negative-sequence quantities and will appear, if present, across the terminals of the delta-connected capacitor bank. The fifth was the only appreciable harmonic found to appear on this system. Measurements of the fifth harmonic voltage made with the capacitor bank off indicated that the lowest values existed near large synchronous machines. It was concluded from this that the fifth harmonic voltage was being short circuited by synchronous machines through their negative-sequence reactance, and that it was caused by the fifth harmonic component of transformer exciting current. Another indication that transformer exciting current was largely responsible was the observation that a 3 percent increase in fundamental voltage resulted in a 10 percent increase in the fifth harmonic voltage.

Impedance Value

Impedance of the capacitor bank to fifth harmonic currents is 0.23 ohm per phase and part of this is canceled by the reactance of the 33/2.4-kv. transformer, through which the capacitor bank is connected to the system. The result is an average measured value of fifth harmonic under operating conditions of 40 percent of the fundamental current or 480 amp. for the entire bank, and an increase in fifth harmonic voltage on the 2.4-kv. bus when the capacitor bank is on. The latter does not exceed 8 percent of the 60-cycle voltage and is not objectionable. By adding sufficient reactance (0.6 ohm on 60-cycle basis) to that already in the transformer bank supplying the capacitor, so that the total inductive reactance to the fifth is equal to the capacitor bank reactance, the fifth harmonic voltage could be practically eliminated on the 33-kv. bus, and the capacitor would absorb a large share of the system fifth harmonic current. With the present operating conditions, addition of the capacitor bank results in a 50 percent increase of fifth harmonic voltage in the region near the bank and a 65 percent decrease at more distant points with the entire bank in operation. Effect of the capacitor bank on the harmonic voltage is not considered sufficient to be either detrimental or beneficial, and was investigated more as a matter of general interest than importance.

Relays Prevent Surge Tripping

Automatic circuit breakers capable of isolating an entire section of the capacitor bank were used in place of individual fuses. The failure of a unit may result in a short outage of one section if the fault does not clear itself, but experience has indicated that such failures are extremely rare. Should a fault occur in one of the units, there will probably be insufficient energy generated in that unit, during the short time required for the relay circuit breaker to operate, to damage more than the faulted unit. Tests have indicated that the current required to trip the breaker will be accompanied by sufficient energy to distort visibly the faulted capacitor and indicate its location.

High-speed induction relays were recommended for fault protection so that a slight time delay of two or three cycles could be introduced to prevent the initial energizing surge current from tripping the breaker. This delay is not sufficient to interfere seriously with the fault clearing time and experience has shown that it is sufficient to prevent trip-outs at the time of energizing. The relay current setting is such that the bank is protected against overload due to overvoltage or other causes such as harmonic currents.

Breaker Control

Circuit breakers supplied with the three sections of the bank are controlled manually at present, but it is planned to install automatic control at some future date. When this is done the bank may be made to act much the same as a step-voltage regulator.

The capacitor bank has been in operation nearly a year and has given satisfactory service with the exception of the failure of one out of the total of 333 units. This unit failed due to a manufacturing defect a short time after the unit was energized and cleared itself internally without tripping the breaker or damaging adjacent units. The bottom of the unit was blown loose, but otherwise the steel case was not deformed.

Board Tests Single- and Polyphase Meters

Co-ordinated switching provides for testing indoor or socket meters of two-wire, three-wire, polyphase and three-element types at three voltages for power factor and element balance

C. IATONNA, Pennsylvania Power Company, New Castle*

RELATIVELY simple connections, in conjunction with use of dial switches to select desired combinations, serve to establish a meter test board on which single-phase (two-or three-wire) and polyphase (two-or three-element) can be checked with equal facility. In certain instances two or three such switches had to be ganged on a single shaft in order either to provide enough contact points or to isolate circuits from one another.

Switch Functions

Switch No. 1 consists of two nine-point units on a single shaft. Its function is to select the connections for (1) separate, (2) series or (3) opposition test of polyphase elements. Switch No. 2 selects for two-wire, three-wire or polyphase meters. Switch No. 3 selects for light load, heavy load. Switch No. 4 selects for current rating. Switch No. 5 is a three-unit switch and selects the voltage combinations to correspond with the settings of switch No. 1 for various meter coil situations (two-wire, three-wire or polyphase); the same switch chooses the power factor, by shifting to the leading phase so as to stimulate lagging current at 50 percent power factor angle.

* Superintendent of Electric Meters.

The various ohm and watt values of the loading resistors are as follows, to produce the desired currents in series arrangement:

Full-Load Units

Amperes	Watts	Ohms	Size Wire
2.5	30	4.8	10
5	60	2.4	10
10	80	0.8	8
15	144	0.65	8
25	300	0.48	8
50	400	0.16	2
75	1800	0.32	2

Light-Load Units

0.25	3	48	12
0.5	6	24	12
1.0	8	8	12
1.5	14.4	6.4	12
2.5	30	4.8	10
5.0	40	1.6	10
7.5	180	3.2	10

The connections shown at the top of Fig. 1 are for a socket-type meter. "Indoor" meters are hung on a hook and the connections made by jumper from studs.

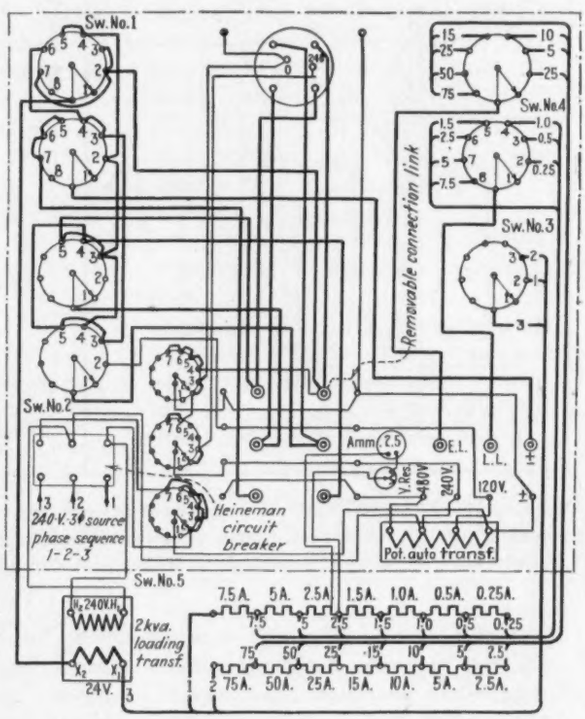


FIG. 1 — Back-of-board arrangement of custom-built meter test table shows how Ohmite dial switches are connected to cover all common combinations on one board. Except for the cabled resistor leads the heavy lines represent No. 2 wire and the light lines No. 12 switchboard wire

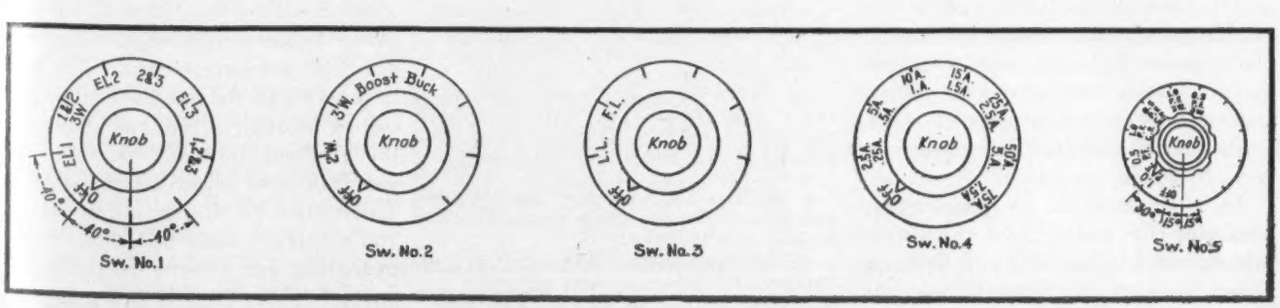
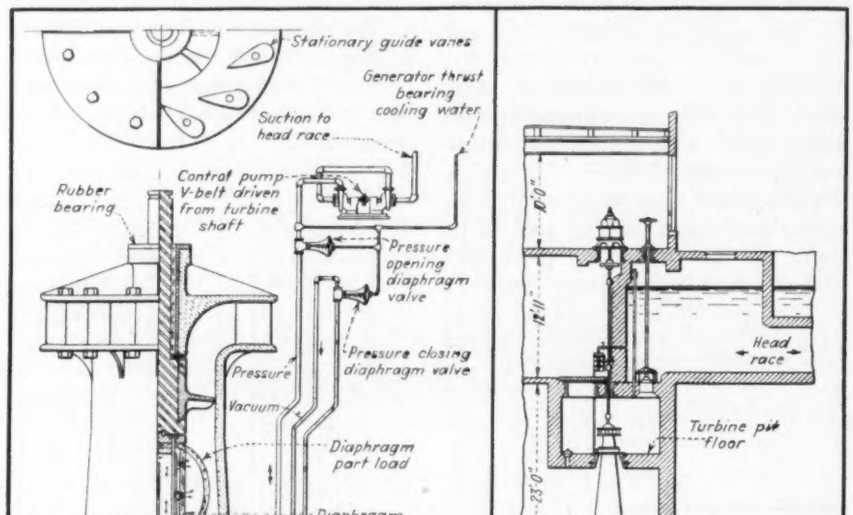


FIG. 2—Front-of-board pattern interprets connection of Fig. 1 in terms of desired combination and settings. Switches 1, 2 and 4 are Ohmite No. 608T2 (with knobs No. 5108), switch 3 is No. 608T1 (with knob No. 5108) and switch 5 is No. 312T3 (with knob 5U1). All dials are made of 1/16 in. polished black sheet Bakelite

Wicket Gates Eliminated in Low-Cost Waterwheel Governor

Low-cost, low-maintenance governor scheme for small waterwheels eliminates wicket gates and elaborate under-water, gate-operating mechanism — Experimental installation proves successful



SCHEMATIC ARRANGEMENT of waterwheel governor system showing arrangement for mounting resilient tubular diaphragm in throat of draft tube below turbine runner (left). At right, sectional view of experimental waterwheel installation at Clarkson, Mich.

COST of hydraulic governors, wicket gates and their associated operating linkages have long been a large item in the first cost of small waterwheel installations, and, once installed, the problems of maintaining the many under-water bearings and metal-to-metal contacts associated with wicket gate operating mechanisms of such units have contributed disproportionately to operating costs.

In attempting to overcome these obstacles to wider use of waterwheels in 25 to 100 hp., and perhaps larger sizes, a new low-cost governing system has been developed at the engineering laboratories of the Ford Motor Company, Dearborn, Mich., which, for units of this size range, appears to have several advantages over the more conventional wicket gate and hydraulic control system.

1. There are no wicket gates, gate shafts or under-water linkages employed. Therefore, first cost of the complete unit is less.
2. Since the governing elements consist simply of a centrifugal pump, compensating diaphragm valves and connecting piping, cost of that portion of the hydraulic control is less than the corresponding hydraulic governor.
3. Absence of elaborate underwater gate-operating mechanisms reduces maintenance to a minimum.
4. Since no moving wicket gates are required, in connection with governing, it has been possible to provide adjustable guide vanes which can be set at the most efficient angle to guide the water correctly into the runner over the entire load range. This contrasts with the conventional wicket gate arrangement where the guide angle is correct at full load position only.
5. Speed control at normal load changes appears to be as good as obtained with units employing the conventional wicket gate and hydraulic governor arrangement and speed recovery after applying or dumping 100 percent load appears to be better than is obtained by that method.

Resilient Diaphragm

In essence the governing scheme employs the contraction and expansion of a resilient tubular diaphragm in the throat of the draft tube, immediately below the turbine runner, to vary the area of the throat opening in proportion to the load changes. This allows more or less water to pass the runner as load conditions require.

Expansion and contraction of the tubular diaphragm is actuated by water pressure, which fluctuates in proportion to the speed of the turbine. Water for operation of this closed pressure-control system is taken from the head race and boosted in pressure by a centrifugal "governor" pump which is driven by belt from the turbine shaft.

In practice, the operation of the complete unit is as follows: Assuming that the penstock is unwatered, plug valves are opened, admitting water from the head race to the penstock. As the turbine starts, water under head pressure is further boosted in pressure by the governor pump and passes through a pipe, as shown, to the resilient tubular diaphragm in the draft tube below the runner hub. This causes the diaphragm to expand and partially closes the throat of the draft tube and returns the turbine to normal speed. At this point any application of load tends to slow down the turbine and governor pump, which reduces the water pressure in the

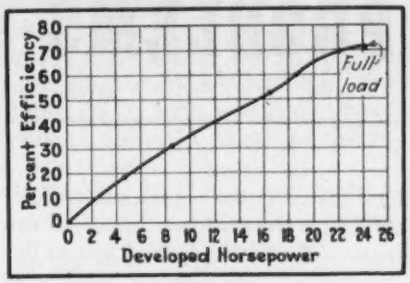
tubular diaphragm. Water from the diaphragm returns to the penstock through the pump, which action is further accelerated by the head water pressure on the outside of the tubular diaphragm and the turbine is again restored to normal speed. Reverse conditions prevail when reductions in load occur. To provide more rapid response to speed changes and to prevent speed hunting, as well as to permit speed drop adjustments to be made and to enable paralleling of the driven generator with other units, a system of diaphragm control valves has been provided as shown.

Diaphragm Control Valves

These consist of (1) a pressure-opening diaphragm valve in the pipe line between the governor pump and resilient tubular diaphragm and (2) a pressure-closing diaphragm valve in the pipe line between the resilient tubular diaphragm chamber and the upper end of the draft tube immediately below the tubular diaphragm. Both of these diaphragm valves are actuated by pressure from the governor pump.

All water passes back and forth, to and from, the penstock through the governor pump and resilient tubular diaphragm. The governor pump supplies cooling water to the thrust bearing at the top of the generator and a small amount of water also passes from the governing system through the pressure closing diaphragm valve to the draft tube each time the valve opens. The small amount of water thus bled from the discharge of the governor pump serves to keep the pump cool and the system alive and free from air.

This system of governing has been installed and operated successfully for several months on a 25-hp., 900-r.p.m. propeller-type waterwheel driving a 25-kw., 120/240-volt d.c. vertical shaft generator at a small plant of the Ford Motor Company at Clarkston, Mich. A cross-section through the waterwheel is shown. The actual operating head of this plant is 29.5 ft., but to enable testing a weir has been constructed in the tailrace, which reduced the effective head to 28 ft., and the efficiency curve reproduced was made under this condition. Water is admitted to the wheel through twelve equally spaced, fixed, airfoil guide vanes and a throat opening of 4½ in. The propeller has five

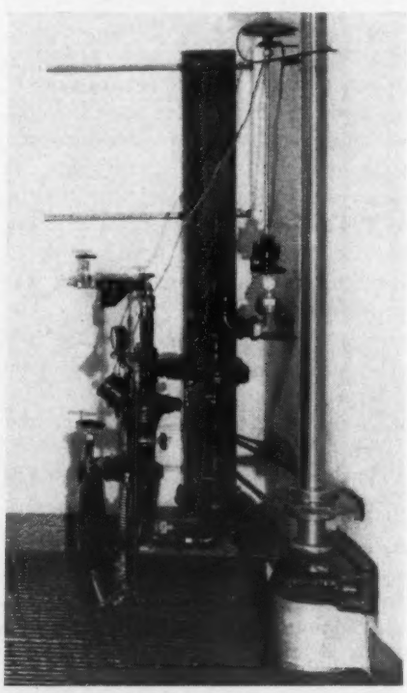


EFFICIENCY CURVE for experimental waterwheel

removable blades, is 12 in. in diameter and has a hub diameter of 6 in.

The 6-in. diameter, stationary, resilient, tubular diaphragm is located immediately below the wheel hub and is mounted in the 12-in. diameter throat of a standard 13-ft. draft tube, which is submerged some 16 in. to 18 in. in tail water at its lower end.

Tubular diaphragm is mounted over and bolted to a hollow, perforated cast-iron core, to which control water is admitted through a pipe leading successively through the pressure-opening diaphragm valve and governor pump to the penstock. From the tubular diaphragm support a pipe also leads through the pressure-closing diaphragm valve (actuated by governor pump pressure) to the top of the draft tube.



SHAFT-DRIVEN centrifugal governor pump and diaphragm valves control water pressure applied to resilient diaphragm in waterwheel draft tube

The governor pump which supplies the varying water pressure required for operation of the resilient diaphragm is "V"-belt driven from the main waterwheel shaft through adjustable diameter pulleys and operates at a speed ratio of approximately 2:1. Adjustment of the pump speed through adjustment of the pulley diameters permits changing the waterwheel speed. A pressure of approximately 38 psi. is required fully to dilate the tubular diaphragm.

As previously mentioned, a small amount of water is continuously bled from the governor pump discharge through the Kingbury thrust bearing at the top of the generator. This serves the double purpose of keeping the bearing and pump cool and the closed governing system free from air.

Long, Closed Penstocks

It might be noted here that it is the builders' belief that should this type of control be applied to plants employing long, closed penstocks the resilient tubular diaphragm would be compressed by the inertia of the column of water and would relieve excess pressures without the use of other safety features.

Failure of the resilient tubular diaphragm during light load operation does not seem to present a hazard, provided the driven generator is equipped with over-voltage release, because modern waterwheel generators are built to withstand 100 percent overspeed without damage.

Speed recovery for the Clarkson unit has been found very satisfactory. On applying 100 percent load, speed reaches normal in about four seconds, while on full load rejection speed returns to normal in about six seconds.

This experimental unit, with its resilient diaphragm control, has been in regular operation for several months and has given very satisfactory performance. A 35-kw., 90-r.p.m., 120/240-volt d.c. steam-engine-driven generator is located in the same plant and the two units are operated regularly in parallel without difficulty.

Equipment was designed and built at the engineering laboratories of the Ford Motor Company by H. Amerman and C. R. Voorhess working under the direction of Henry Ford. These men also designed all the hydraulic features of the plant in which it was installed.

PRIORITIES PROBLEMS

Recapturing Excess Authorizations

Case No. 63

Not every instance in which the Office of War Utilities allows a utility to exceed its delivery quota for a given item constitutes an enduring, permanent authorization to exceed. This is shown by the case of a company which, needing poles, found that it was unable to purchase a carload without exceeding its quarterly delivery quota.

The utility asked OWU whether it should buy poles only in the amount permissible under its Order U-1 quota, or whether it should apply for specific permission to exceed its quota so it could purchase a carload.

The answer was that it is preferable to apply for authorization to exceed the U-1 quota. OWU has no intention of handicapping a utility in the purchase of commercial quantities of any item. This is particularly true in cases which involve an actual increase in the transportation burden, an obvious result if many poles were purchased in less-than-carload lots. In making application for authorization to exceed, the utility should show a corresponding decrease in delivery quotas for the same control class in subsequent quarters.

For instance, the utility which normally buys two carloads of poles a year would probably be given immediate authorization to exceed quarterly delivery quotas to a degree sufficient to purchase a carload in each of two quarters. The dollar value of these deliveries, then, would be split four ways and charged to four quarters, including the two in which the deliveries actually were made. Thus, there would be no permanent authorization for the company to exceed the limits of that control class, and at the end of a year, the company would not have received total deliveries in that control class whose dollar value was higher than that allowed for one year.

Pole Replacement Programs

Case No. 64

Despite the general reduction in withdrawal and delivery quotas under Order U-1 from the standards of Order P-46, there is no disposition on the part of the Office of War Utilities to let plant suffer just to keep utilities in strict conformance with the provisions of U-1. While materials are to be used even more conservatively than they were a year ago, they will not be withheld captiously.

An example of this philosophy is to be found in the case of a company which, because of a shortage of labor and an unusually large construction program last year, failed to keep up with its normal pole replacement program. Came a slackening of construction and the company prepared to catch up on its pole program, only to find itself impeded by U-1, in which pole deliveries and withdrawals were curtailed to a percentage of those used during the last nine months of 1942. Under the letter of U-1, the company would have been unable to catch up, for its pole use in 1942 was considerably below normal. The company came to OWU asking specific authorization to exceed its pole delivery quota sufficiently to catch up with the delayed 1942 program and carry out its normal 1943 work.

The company got permission to exceed for the remaining months of 1943. The authorization was not extended beyond that date on the basis that at the end of the year, it would be in OWU's interest to review the company's pole program in the light of the then-existing material situation. In effect, this authorization will allow the company to complete its 1942 pole program by the end of 1943. If pole supply is at all good next year, it is reasonable to believe that the company will then be allowed to complete its delayed 1943 program. Thus the utility will never get in serious danger and a certain amount of material will have been saved.

Scrapping Replaced Equipment

Case No. 65

The Office of War Utilities emphasizes the desirability of returning to useful channels all material and equipment replaced by newer units, even when such replacements are permissible without specific authority under the terms of Order U-1. This emphasis is illustrated by the case of a utility which posed a question relating to the replacement of a boiler feed pump which was described as practically out of commission.

The proposed replacement was of a modern design and of greater capacity than the old pump. The difference between the cost of the old and new pump was $450. Since the old pump was not operable in the existing installation, and the cost difference was within the $500 limitation, and the greater capacity was necessary to maintain minimum service standards, the purchase and installation was permissible under U-1 without specific authorization. However, the company wanted to retain the old pump as a standby instead of scrapping it. This immediately raised the point that if it was operable as a standby it might be repaired to operate without replacement. Since the company admitted that the old pump was not repairable and that satisfactory service had been maintained for years without a standby, OWU ruled that the old pump should be scrapped.

If the company were convinced that the old pump would have more value as a standby than as scrap, OWU ruled, it should come in, as it

RUTILITIES WHICH PETITION successfully for an increased inventory base and then fill the authorized increase from stocks already listed as excess should make certain to report these withdrawals from excess to their regional inventory control office. Unlike the case of a sale from excess, which must be reported immediately, such a transfer need not be reported at once unless it effects a substantial change in the excess balance of one or more items of commonly used equipment. If no such substantial change is made by the filling of the new inventory quotas from excess stock, then the transaction need not be reported until the end of the first calendar quarterly period after the change is made. At that time, in reporting the changed excess balance, the reporting company should indicate the reason for it.

did, with a request for authorization to hold the old pump as a standby despite the fact that, with the net material cost under $500, it could do so automatically under U-1.

The propriety of replacing equipment is based on the three provisions of Pargaraph 7 (ii) and 8 of U-1's definitions. First criterion in judging the feasibility of any such change is whether the old equipment will do the job so as to meet minimum service standards. In the case at hand, the company decided it would not.

Second criterion is whether the replacement is of better "kind, quality or design." In this case the new pump obviously was of a better kind, quality and design, for it would be pointless to buy an old-fashioned, inefficient pump even if one could be found, and it was desirable from the point of view of plant operation to have a pump of increased capacity.

The third criterion is that of net value of the addition, or whether it is over or under $500.

A corollary to the foregoing case illustrates the fact that there are exceptions to the scrapping rule. Another company found that the increased demands of one of its customers badly overloaded the transformer bank serving his establishment.

Applying the three tests referred to above, the company concluded that the transformers were still operable at rated capacity, but were unable to furnish service in this specific installation at minimum service standards; that the transformers which were to be installed to handle the increased load were not of better kind, quality or design, and that the net material cost of the change was less than $500. On the basis of these findings, it decided that the change was not only legal but logical.

Inasmuch as the transformers were still perfectly good, merely of insufficient capacity for the given job from which they were to be removed, scrapping of operable equipment was not required, and they were properly returned to inventory. Had the transmission and distribution class of its practical working minimum inventory been above the maximum allowable limit, the transformers would have gone into excess, or some material, equal in dollar value, already in the transmission and distribution class of the company's PWM would have been moved into excess to make room for the displaced transformers. In the latter case, of course, the company would have reported the availability of the new excess at the end of that calendar quarter to the Inventory Control Branch.

The reasoning displayed here is similar to that used in deciding Case No. 58, "Salvage Reduces Project Cost" (ELECTRICAL WORLD, May 15, 1943, page 68). In that case the company which wanted to replace operable line, to shorten it and to provide better service, applied to OWU because its case met only two of the three standards. The net cost was under $500 and the line was not in condition to give service at minimum service standards. However, in shortening the line it proposed to meet local difficulties by using stronger conductor, which caused the project to run afoul of the criterion banning any betterment in kind, quality or design. Very properly that company applied to OWU for approval, which it received, of its use of improved conductor.

Spares Not in Plant

Case No. 66

It is not unusual, under the complexities of Order U-1, to encounter situations in which the letter of the order must be followed despite apparent injustices. In such cases, the philosophy of the Office of War Utilities is to require that the order be complied with to the last degree, to keep the record straight, and then to make some sort of special provision which will safeguard the utility's ability to operate efficiently.

One such case was posed by the company which explained to OWU that it made a practice of keeping its spare transformers on the warehouse shelf rather than actually installed in plant. It pointed out that by such practice, it was able to provide sufficient spare capacity with fewer transformers than it would require if the units actually were installed. On the basis of this saving, the utility argued, and on the basis that the transformers really were spares rather than inventory, it should not be required to include these units in inventory as required by Order U-1, which classes as inventory everything not actually physically installed in plant.

The company was advised to include the spares in inventory, complying thus with the letter of the order. It was then advised that if such inclusion in inventory of equipment classified as spare forced other material actually needed in working inventory into excess inventory, it should ask special authorization for an increased inventory base in the transmission and distribution control class. Such application should include an explanation of the circumstances necessitating an increased base. By this procedure, the provisions of U-1 are satisfied and the company is safeguarded against possible operational difficulties arising from incomplete working inventories.

The utility asked further whether, since its normal practice with respect to spares was no longer permissible, it could install its spares in plant without including them in the withdrawal quota of the quarter in which such installation was made. It was advised that, without special authorization to the contrary, such withdrawals would have to be included in the quarterly quota. It was further suggested that the company apply for authorization to make the installation and exclude it from the quota. Where the practice of holding spares in the warehouse rather than actually in plant was bona fide, the utility was told, such authorization normally would be granted.

BUTILITIES SEEKING TO PURCHASE materials or equipment from the excess stocks of other companies must keep in mind that in addition to clearance from a regional redistribution office, definite ratings or specific authorization to buy from excess stocks are required on their purchase orders. For maintenance, repair and operational purchases, of course, the buyer applies the AA-1 rating automatically assigned by Order U-1. On orders purchasing equipment for rated projects, the buyer assigns the project rating, or furnishes a copy of the authorization to buy from excess stocks if no rating was assigned to the material being purchased. Project ratings below AA-3 may not be honored from excess stocks except in the case of copper wire, cable or busbar and any kind of pipe. These items, with a few other less consequential kinds of equipment, are subject to Priorities Regulation 13, which allows inter-company sales on ratings of AA-5 or better.

Editorials

S. B. WILLIAMS, *Editor*

Brownout Gives Way to Voluntary Conservation Program

NOTHING in all the war regulations has stirred the electric power industry quite so much as the threatened brownout scheduled to begin early in July. While it has unequivocally been stated by the Washington authorities each time the brownout was brought up that it in no way was caused by any impending shortage of power, there has always been some misgiving that this measure was never wholly justified, because neither the administrator of fuel nor of transportation would come out positively for the brownout to save fuel or transportation or both. This lack of forthrightness gave rise to the suspicion that there was a nigger somewhere in the woodpile.

At a meeting this week between OWU officials and a representative group of the industry these misgivings were cleared away when the need was explained for a big over-all national conservation program of which power is but a part. Obviously, this goes beyond the brownout and includes the saving of everything that is not absolutely necessary to be used. And because this program includes all the nation, there will be no singling out of the power industry by means of a mandatory brownout at this time. Instead the industry will voluntarily put its shoulder to the wheel, as it always has in the past when the need was shown.

From the reduced use of electricity a fuel saving of approximately two million tons is expected. This and probably more, the utilities will save. It is only hoped that the Office of War Mobilization, under whose direction this across-the-board program will be managed, can secure equally significant results from other sectors of industry and the public. It would be unfortunate indeed to have the power industry inconvenience its customers sufficiently to save two million tons of coal while the coal strikers blow five or six times that amount in a single week.

This voluntary program is not to be considered an easy substitute for the brownout. In fact, it is much more difficult, because by accepting the responsibility for making conservation really effective, the industry must be ceaseless in its efforts to show its customers how to conserve in the use of electricity.

Conference Method for Review of Power Contracts

IN REPORTING on the savings to the government that have already accrued out of the operation of the President's "lowest cost" directive last fall Basil Manly, vice-chairman of FPC, took pains to point out to a meeting last week in Chicago that the conference method of review of war power contracts prior to execution was not something new.

The commissioner further stated that FPC is not seeking to deprive any utility of a penny to which it is justly entitled for the service it performs. It is easy to say that prior to the execution of a contract because at that time all of the conditions of service can be stipulated and made a part of the agreement. In the matter of renegotiation, on the other hand, a subject which the commissioner appears from the official release not to have discussed, the conditions of service are fixed by virtue of the fact that the load is being served. The company has spent its money for the facilities and it therefore can't negotiate on this point. The best it can get is nothing; *i.e., status quo.*

We agree with the commissioner that the conference method is always the best approach to any negotiation. It presumes a willingness to discuss terms amicably. But if it is good for negotiation of new contracts, why isn't it good for renegotiation? Why is it necessary to have such riotous hearings as the one at Little Rock? We presume from the commissioner's remark that the conferees approach their problem with wide open minds, eager only to have the facts. Apparently there is a wide divergence from this approach of the commission's technical staff and that of its legal staff.

Perhaps we were wrong, but we thought we caught in his remarks a note of pride that there was a part of the commission's staff that could work in harmony with the industry which it was regulating. Considering the bias expressed by certain commissioners at different times, as well as the actions of trial examiners at others, Mr. Manly has every reason to be proud that members of the private industry could ever sit down trustfully with any group from the FPC staff. This thing that so pleases the commissioner is common practice with other regulatory bodies that enter upon their jobs, first, with an open mind and, second, with a desire to be understanding so that their decisions may be fair to all and uncolored by any political or socio-economic bias.

Co-op Regulation

IS A rural co-operative entitled to any special consideration when it goes into the utility business? This question must be settled from the standpoint of regulation, special rates, taxes, rights-of-way, etc.

So far the co-ops have insisted that as membership outfits there was no reason for regulation of their operations. What they did to and for themselves was their business and nobody else's, to put it bluntly. And so long as they stayed in that category there was some logic to their position. However, when they started to serve small industrials, communities, then the war camps and even large plants, their position was no longer tenable. The Indiana commission pointed that out this spring.

Another phase of the matter is now before the Arkansas commission. The decision is bound to have a profound effect on the direction of REA expansion.

In that state co-ops enjoy a special development rate from the supplying utilities. The utilities contend, however, that this rate may not apply to energy furnished a community that has been enjoying service, but which has come into the co-op's jurisdiction by way of purchase. The special rate is solely for the purpose of enabling the co-op to develop usage in areas not primarily served. The case is one of discrimination, because if a private utility was furnishing service to any of these communities it would have to pay the standard rate.

Obviously, if the Arkansas commission decides in favor of the co-ops, and its decision becomes a precedent for other state commissions, it will be to the advantage of any co-op to buy up as many small towns as possible. The return after the very favorable special rates will permit the co-ops to amortize the entire investment in a shorter space of time. On the other hand, if co-ops must be regarded as utilities when engaging in the utility business, then the urge to expand except in the direction defined in the REA act will be gone.

Little by little precedent for regulating co-ops is being accumulated. Obviously, the co-ops, having received their start through paternalism, feel they are entitled to some special privileges. It is equally obvious to others on the outside, who are conscious of the good the co-ops can do in extending electric service to areas that otherwise would not be reached, that discrimination would wreck the co-ops. It would throw them into politics, and it wouldn't be long before they would lose all sight of their primary goal in favor of the spoils from purchased communities.

Lumens, Not Foot-lamberts

WHAT has brightness to do with sky-glow? This remark is occasioned by the regulations of the First Service Command for New England which became effective May 31 and for a manufacturing plant provide that "average brightness outside of any . . . openings . . . shall not exceed one (1) foot-lambert and . . . the maximum brightness at any point outside . . . openings shall not exceed three (3) foot-lamberts."

Since dimout regulations are for the purpose of reducing sky-glow, wouldn't it be more appropriate just to continue as in the past to measure the flux of light, or lumens, that help to produce the effect? Brightness is not a cause, it is an effect. Just because it is proportional among other variables to the light flux is no reason for treating it as a cause.

Moreover, the regulation fails to prescribe the surface upon which the brightness is to be determined, its location, direction of exposure, inclination and the angle from which it is to be viewed. How can it be controlled if not defined, for a foot-lambert is the average brightness of a surface emitting or reflecting light at the rate of one lumen per square foot?

So we ask, if brightness isn't the cause. if it hasn't been prescribed, why such a regulation? Isn't the dimout sufficiently discouraging as it is?

On the Air

AFTER a year and a half of national magazine advertising the electric utilities are going on the air. This is a splendid move for it will enable them to reach an additional audience and in a more informal yet intimate manner. There is a big job still to be done in public education, as has been indicated in a recent survey of public opinion. This radio program added to the magazine schedule should help greatly to erase from the minds of customers the misinformation they have regarding the industry's service.

When the advertising campaign started in December, 1941, there were 52 operating companies contributing. This number has slowly but gradually increased to 121, and as the radio program gets under way in another month more are expected.

The industry should be proud of that small band of operating companies that not only had the courage to advertise nationally but the faith to tell their story. They are carrying the ball for the entire electric utility industry, regardless of the fact that others who are not contributing are nevertheless enjoying just as great benefits per customer as those who are paying the freight.

Of course, in every industry and every society there are some who are always willing to let the other fellow pay the check. The number in the electric utility industry is perhaps larger because of the disinclination to engage in anything that might bring them into any additional contacts with federal regulatory bodies. That attitude is understandable after the punishment the industry has taken in the past decade, but now, perhaps, is the time to consider the value to be received individually from a stronger industry.

After all, the industry, as well as its political persecutors, has a common boss—the public. Its opinion is essential to corporate well being. It can't be cultivated, however, with pennies.

Washington Comment

By R. N. LARKIN, Washington Correspondent

Dirksen Power Bill May Be Amended to Death

THE Dirksen bill, to consolidate under a single administrator all the federal government's multitudinous functions with relation to electric power (ELECTRICAL WORLD, May 29, page 57), is like an old folksong, which, after passing unrecorded from generation to generation, is finally accorded the dignity of transcription on paper.

Ever since the federal government got into the power business in big league fashion, which in general is within the last ten years, many people have discussed the idea of having all its physical operations in the field unified, under a single head, operated under one policy. But the Dirksen bill seems to be the first recorded attempt to achieve that end for all functions.

Proponents of the bill point to the hodge-podge of committees, bureaus, departments, agencies and commissions as the best reason why the bill should become law. They buttress their argument with the indisputable point that the government has lots of money in the power business and is pouring in more all the time.

Difficulties

Opponents muster many arguments against the bill, some based purely on mechanical reasons why it would be difficult, possibly disastrous, if not impossible, to consolidate all federal power functions as proposed by the Illinois Representative.

It's not very hard to find opponents of the Dirksen plan who agree that it would be very nice if all federal power production activity could somehow be consolidated in the fashion and to the degree advocated by the bill. It's a considerably harder task to find many people who think the plan, as submitted, is workable.

One private company man, in Washington for the duration, guessed that the electric utility industry would not enthuse over the bill because "how could there be any fair competition between public and private power under such a consolidation?" He argued that if such competitive agencies as TVA and REA were combined into one with such regulatory agencies as FPC and SEC, private companies would be in the unhappy situation of having to compete with the Office of Power Administration under restrictions imposed by the Office of Power Administration.

This argument is not wholly valid inasmuch as the Dirksen bill specifically exempts from the new agency all those FPC functions dealing with regulation, investigation and adjudication of rates. But it has point in that other FPC functions, such as determining where power and multipurpose dams may be built and how their costs shall be allocated—both of them vital to a competitive situation—and all SEC's electric utility regulatory functions would go to the new agency.

Obviously, the provision exempting FPC's rate regulation functions from the proposed consolidation is an attempt to keep "Cunning Old Fury" from serving both as judge and jury. However, it is an admission that at least one segment of the existing federal power set-up should not be consolidated with all the others. That admission serves as a starting point for partisans of other federal power agencies, whence they can argue that if one function can be excepted, so can another, and another and—finally—all of them.

A good example of this chipping away process might almost certainly be found in TVA. A tenet in the creed of TVA Chairman David Lilienthal—which he has argued steadfastly and successfully—is that TVA must have autonomous and decentralized, "outside-of-Washington" administration. Aside from the purely political aspects of any opposition TVA might make to the Dirksen bill, it could and probably would be argued in Congress by TVA's admirers that if autonomy and decentralization helped TVA compile the record of its first ten years, more of the same would not be amiss. If such argument were successful in eliminating TVA from provisions of the Dirksen bill, similar arguments probably would do the same for the other agencies, and the bill would thus be amended to death.

From the viewpoint of SEC, there arises serious question as to whether part of its functions could properly be administered entirely apart from its other functions.

Social Gains

There arises also the question of what effect the Dirksen bill might have on the "social gains" represented by such agencies as TVA, REA, SEC and other non-war agencies. Thus far through the war, there has been little tendency to abandon these "social gains" for the duration. It is not inconceivable that, unless there were a decided change of heart regarding the worth of these "social gains," the Administration might muster sufficient strength to amend them out of the bill.

Then the Dirksen bill requires WPB to consult with the Federal Power Advisory Committee (which it establishes), so that government policy on electric power shall be unified and co-ordinated. In so far as this requirement might force the Office of War Utilities to fall in line with policy not of its own making and not to its liking, it would probably draw the fire of WPB. Of course, the life of WPB presumably is limited to the duration of the war, whereas that of the Dirksen bill, should it become law, is indefinite, but of longer reckoning, at least, than that of WPB. But WPB could conceivably argue that subjugation of OWU to policy drawn up by another agency could infringe upon the powers granted it by the President.

If the War Production Board were to argue for and win exemption from the Dirksen bill, it would weaken the plan considerably, for WPB controls everybody's power program for the duration.

NEWS OF THE WEEK

"Brownout" Shelved for Conservation Program

OWU meeting emphasizes that conservation objectives of proposed "brownout" might be equally well obtained by broad drive to conserve coal, transportation, manpower and critical materials

A mandatory "brownout" within a month for conservation of coal and transportation has been laid aside, at least temporarily, in favor of a broad conservation program whose scope will extend far beyond the confines of the electric utility industry.

This was the outcome of a meeting this week between J. A. Krug, director of the Office of War Utilities, and 35 representatives of the industry, both public and private.

"Task Force" Appointed

Reports from the meeting emphasized that the over-all conservation program, which will be initiated in the utility industry by a "task force" selected shortly after the meeting, will encompass all possible savings of coal, transportation, manpower and critical materials, no matter where they may be effected.

Utility representatives agreed that the conservation objectives might be obtained equally as well on a voluntary basis as upon a mandatory program.

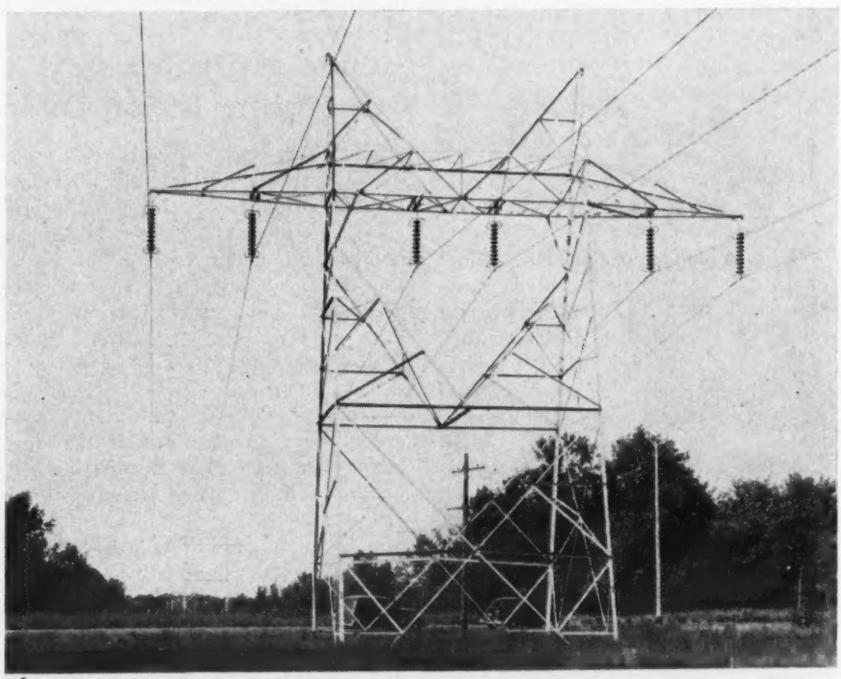
It was further emphasized at this week's meeting that, as far as the utility industry is concerned, "any conservation measures undertaken would be for the purpose of saving fuel, materials, transportation and manpower, there being no shortage of electric-generating capacity."

An OWU spokesman said the industry representatives would give "wholehearted support to any necessary conservation program managed by the government." He added that another meeting with industry representatives will be called when the "task force" committee has outlined a utility program for consideration.

Krug emphasized that no action will be taken on any program until the subject has been thoroughly discussed with the entire electric industry.

It was indicated that the over-all conservation program, of which the electric power industry's program would be only a part, presumably will be managed by some such "top drawer" agency as the Office of War Mobilization, and will be aimed at "across-the-board" savings by industries and civilians of every material which should be saved.

No date has yet been established for the next meeting of the industry representatives with OWU officials.



HIGHWAYS TO VICTORY—Eastern industrial plants, munitions works and other vitally important users of electrical energy benefit by the completion of this double-circuit, 110-kv. transmission line running through a district formerly served by 66-kv. lines delivering steam-generated and hydro-produced electricity to populous centers. The company's foresight in the planning of system betterments aggregating nearly $5,500,000 enabled war-product plants of major consequence to be supplied with adequate service under pressure of military requirements without delay

HIGH-FREQUENCY HEAT SPONSORS—Group at head table at annual meeting of the Power Engineers Association in Boston May 26, when high-frequency electric heating was the major topic of discussion. L. to r., J. L. Faden, Boston Edison Co., power sales department, who reviewed such installations in the Boston area; P. V. Hayden, Connecticut Light & Power Co., chairman-elect of the association; V. W. Sherman, manager of the industrial electronics division of the Federal Telephone & Radio Corp., Newark, N. J., who spoke on "Thin Case Hardening with Radio Frequency Energy"; Jack L. Calpin, Public Service Co. of New Hampshire, newly elected vice-chairman of the association; and J. V. Dempsey, Central Vermont Public Service Corp., Rutland, executive committee member. C. R. Broadhead, manager of power sales, Narragansett Electric Co., Providence, R. I., secretary-treasurer-elect of the association, was unable to be present when the photograph was made

Asks Probe of Federal Hydro

Facts on supply and allocation of power sought in new resolution

A resolution establishing a Senate committee to conduct a broad investigation of government hydro-electric generating stations has been introduced by Sen. Ernest W. McFarland, Arizona Democrat. It was referred to the committee on interstate commerce.

Resembles Coffee Resolution

Described by McFarland as "applicable only to the state of Arizona as far as I'm concerned," the resolution bears some resemblance to that now before the House rules committee, sponsored by Rep. John M. Coffee, Washington Democrat (ELECTRICAL WORLD, April 3, page 71, and April 24, 1943, page 15). Each proposes an investigation of power allocation, McFarland's being confined to government hydro capacity.

McFarland's resolution calls for "complete study and investigation" of:

1. Adequacy of the supply of hydro-electric power generated in government plants.
2. Whether such supply is properly allocated and distributed for war and civilian purposes.
3. Whether the distribution of such supply is made under proper conditions and safeguards.
4. The relation between generation of hydro-electric power at government plants and irrigation.
5. Whether plans for future development of government hydro-electric plants provide for full utilization of such facilities in development of both electric power and irrigation.

McFarland told ELECTRICAL WORLD that his interest in such an investigation was confined principally to Arizona, where, he explained, a drought several years ago lowered hydro output to crippling levels. With war plants dependent in large measure on hydro power, he asserted, steps should be taken now to see what would happen if another serious drought should arise.

•

Vepco Must Refund Company Union Dues

The U. S. Supreme Court this week upheld an order of the National Labor Relations Board directing the Virginia Electric & Power Co. to disestablish an independent employees' union, which the board charged was "company-dominated," and return to employees dues collected for membership under the closed shop check-off system.

Chief point at issue in the case was whether the NLRB had the power to order the reimbursement of the dues collected. The court divided sharply on this point. Justice Murphy, representing the majority of six, wrote the opinion upholding the board, while Justice Roberts, joined by Chief Justice Stone and Justice Jackson, filed a vigorous dissent. Prior to this decision five Circuit Courts, in eleven cases, had refused to enforce NLRB orders for reimbursement.

The court's majority opinion ignored the power company's argument that the check-off system of collecting dues was voluntary with the employees, and that dissolution of the union, the Independent Organization of Employees, brought to an end the company's support of the group.

The fact that the utility had given the union closed shop and check-off privileges, Justice Murphy said, thus assuring its financial stability, resulted in the workers having to authorize wage deductions in order to remain members of the union. "Thus, as a price of employment," he continued, "they were required by the company to support an illegal organization which foreclosed their rights to freedom of organization and collective bargaining. To hold that the board is without power to order reimbursement of the amounts so exacted is to hold that an employer is free to fasten firmly upon his employees the cost of maintaining an organization by which he effectively defeats the free exercise of their rights to self-organization and collective bargaining. That this may pervert the purpose of the (Wagner) act is clear."

Dissenting Opinion

Justice Roberts' dissenting opinion, however, held that "the company union having been disestablished, the employees are free to join any union and make it their bargaining agent. Any possible effect of company influence has been dissipated. The only possible effect of restitution of dues . . . is to punish the employer and perchance operate as a warning to other employers that they will similarly be punished for unfair labor practices."

Effect of the decision in so far as Virginia Electric & Power is concerned is that the utility will be required to pay back about $90,000, or all dues collected during the five-year existence of the I.O.E.

Savings on "Cheap Power" Directive Cited by Manly

$1,560,000 in rate charges and $1,983,000 in facility charges saved on 96 contracts, FPC vice-chairman reports — Backlog of 664 cases involve annual demands of 5,375,000 kw.

The Federal Power Commission has brought about savings totaling $1,560,000 in rate charges and $1,983,000 in facility charges on contract proposals thus far reviewed under the President's "cheapest power" directive of October 22, Vice-Chairman Basil Manly told a Chicago conference sponsored by the War Department last week.

96 Contracts Reviewed

These savings, realized on 96 proposed contracts already reviewed, will accrue to government agencies and are apt to mount considerably when FPC has worked off its backlog of 664 cases. Involved in all the proposals and contracts before FPC for review are estimated annual demands of 5,375,000 kw., estimated annual consumptions of 37,500,000,000-kw.-hr. and annual charges of $225,000,000, Manly reported.

The October 22 directive gave FPC the duty of getting for federal agencies the cheapest power available. It also directed the commission to order the use of the facilities of other utilities on a common carrier basis where this might be necessary to deliver the cheapest power to the contracting agency. Recently the General Accounting Office ruled that it would not accept for payment any contract with a demand of more than 1,000 kw., unless the contract had FPC's approval.

Of the 96 contracts reviewed thus far, none have required issuance of a formal order for settlement. FPC, Manly declared, has "chosen to have its staff members sit down in conference with utility representatives and seek to convince them of the justice and reasonableness of the readjustments which they believed to be necessary."

Prior Savings Reported

Prior to issuance of the October 22 directive, the commission carried on considerable review under the framework of its statutory authority. Savings during this period Manly estimated at $466,900 in rates and $1,074,000 in facility charges on gas and electricity contracts.

Of the 664 contracts, 253 are pending on contract proposals, all of them under active study or negotiation. Pending contracts and proposals were taken up first, to be followed by existing contracts.

"We recognize," said Manly, "that all of these contracts for power and gas were negotiated under heavy pressure originally, and it is therefore no reflection on any of the parties participating in such negotiations that rate adjustments and other modifications have been found to be either necessary or desirable."

•

Utility Advertising Going on the Air

The operating electric utility companies which have been conducting an advertising campaign in national magazines for the past year and a half will amplify that campaign, starting July 27, when they begin sponsoring the radio program "Report to the Nation" on the Columbia network.

"Report to the Nation" is a dramatic half-hour presentation of the week's outstanding news. For the past year it has been one of the leading sustaining features of the Columbia Broadcasting System. Formerly heard on Sunday evening at 10:30 (EWT), and later shifted to Saturday evening at 7, the program will be transferred to Tuesday evening, at 9:30, beginning June 15, where it will remain during its sponsorship by the utilities.

One factor which helped to hasten the decision to supplement the magazine campaign with radio, according to N. W. Ayer & Son, agency for the account, was a nation-wide survey just completed on consumer attitudes toward the electric industry. The survey indicated a widespread lack of information and a dangerous amount of misinformation through all income brackets and all educational levels, regarding rates, taxes, profits, ownership and operating policies.

The original group of 52 operating companies started magazine advertising in December, 1941. Radio was under consideration from the beginning, but more contributors were needed to make sufficient funds available. Today the list of contributing companies has grown to 121, according to the agency.

Akron Beacon Journal

TWO-TIMER—Harry C. Kurtz (center) Ohio Edison Co. lineman, had the distinction recently of receiving the Edison medal for lifesaving for the second time. He is shown receiving the certificate from L. G. Tighe, vice-president, while Willis D. Mohn, whose life Kurtz saved in a "pole-top" artificial respiration administration, looks on approvingly. Kurtz last won the award eight years ago while an employee of the Electric Light & Power Co., at York, Pa.

Ruling Delayed on Co-op Rate Decision

Arkansas commission takes under advisement cases where utilities seek authority to raise rates to co-ops which take over distribution systems in municipal areas — Important precedent looms

Arkansas Department of Public Utilities took under advisement on June 2 two cases which probably will become nation-wide precedents in the matter of how far rural electric co-operatives may go in the electric business.

A. P. L. and O. G. & E. Involved

In one instance the Arkansas Power & Light Co. seeks to apply an availability clause in its rates to co-ops which would eliminate from its standard rates to co-ops power sold for resale to towns and communities the co-ops may purchase, and which are already developed from the standpoint of electric service. There are four Arkansas co-ops which would now be affected in this case.

In the other instance the Oklahoma Gas & Electric Co. would apply an availability clause which bars its preferential rates to co-ops for resale in communities of 250 persons or more, or where the transformer capacity is 30 kva or more.

Two days was required for the power companies to present their proof, most of it being offered by the Arkansas Power & Light Co. The Arkansas department denied a motion of the co-ops that that application of the Arkansas Power & Light Co. for application of its availability clause be denied.

From testimony of witnesses, and statements of lawyers for the power companies, it was evident that the utility companies are seeking to curb the activities of the Rural Electrification Administration in the field of municipal operation, and to confine the administration's activities to strictly rural electrification. Officials of the REA at the hearing frankly admitted that the results of the hearing would have nation-wide effects upon their operations.

Rates Were "Developmental"

Cause of the action dates back to an order of the Arkansas Department of Public Utilities in 1937 approving the A. P. & L. standard co-op rate schedule, with a 30 and later a 50 percent discount ordered by the commission. At that time the co-ops were serving only strictly rural customers, under what the power companies contend the REA law authorized. It was brought out at the hearing that the rate was purely a "developmental" rate to help get electricity to the farms, and that to sell co-ops power on this unusually low rate to be resold by the co-ops to municipalities, where the electric services has already been developed, was definitely discriminatory to the other customers of the power company.

C. Hamilton Moses, president of Arkansas Power & Light, and T. J. Blewster, head of the rate department, were the principal witnesses on direct examination. Mr. Moses traced the history of the developmental rate. Mr. Blewster said only four of the co-ops now served by his company would be affected by the application of the new clause: Craighead County Rural Electric Co-operative, North Arkansas Rural Electric Co-operative, Southwest Rural Electric Co-operative and Carroll County Rural Electric Co-operative.

Frank M. Wilkes, Shreveport, La., president of the Southwestern Gas & Electric Co., testified that the late Harvey Couch, who was president of A. P. & L., had informed the department electricity would be given free to co-ops by his company if necessary to get them started on their feet. There never was any idea then that the REA co-ops would seek to go into the big power business by supplying municipalities. Attempts to have him read into the record statements by sponsors of the REA at its creation showing REA was created solely to serve rural customers not before receiving central station service were unsuccessful.

One of the co-op managers whose system would be affected by application of the clause said on the stand that the net return on the investment from his strictly farm customers was 8 percent, while the net return on customers in a municipality where the co-op bought the system was 27 percent. Testimony given in behalf of the co-ops inferred that the co-ops were forced to buy isolated systems in small towns in order to get enough revenue to meet their payments to the government on their loans.

OPA Intervenes

Thomas B. Fitzhugh, who was chairman of the Arkansas Department of Public Utilities when it approved the A. P. & L. rate to co-ops and ordered them discounted, represented the co-ops in the hearing. The three commissioners of the department formally overruled a motion made by Fitzhugh at the opening of the hearing to dismiss the application of the power company.

The Office of Price Administration formally intervened in the hearing

FIBERGLAS STAR—First star on the "E" pennant that flies over the Newark factories of Owens-Corning Fiberglas Corp. was added recently. Left to right, Ben E. Boyd, Newark factories manager; W. P. Zimmerman, vice-president in charge of operations; Lieut.-Commander A. E. Heiser, who made the presentation; and Games Slayter, vice-president and director of research

through Harry A. Bowen, one of its lawyers, from Washington. Bowen contended the application of the availability clause would raise electric rates to a great many customers. Rate Manager Blewster told Bowen from the stand that so far as the power company was concerned only four out of its 125,000 customers would be affected.

Contention of the co-ops throughout the hearing was that if they were not permitted to obtain the developmental rate—which averages about 7½ mills—in towns where they operate, they would have to increase rates. President Frank M. Wilkes of Southwestern Gas & Electric denied this from the stand, saying that the co-ops now pay about 40 cents per month for energy purchased from the power company and resell it to customers for about $2.50 a month. With this vast spread an increase of a few cents per month in the purchase price of power would not affect the price charged to the consumer, he contended.

•

Municipal System Tax Up in Cleveland

An application by the Cleveland municipal transit system for exemption of its property from taxation, now pending before the Ohio Board of Tax Appeals, may open the way to test the constitutionality of existing laws making public property non-taxable. The case is being closely watched by utilities, who see in it the possibility that all municipally owned utilities may become subject to taxation, except that part of their property which is used exclusively for public purposes.

The Cleveland Transit System recently filed a formal application asking that real estate in Cuyahoga County valued at $33,775,930 be exempted from taxation. Later it was agreed the application be amended to include the system's personal property, including rolling stock and other equipment. The case is believed to be the first of its kind to come before the Board of Tax Appeals, decisions of which are subject to review directly by the Ohio Supreme Court.

In view of a previous decision to the tax board that property owned by a metropolitan housing authority is subject to taxation, observers see a possibility that the application of the transit company may be denied in whole or in part. An effort was made recently in the Legislature to tax municipal utilities on the same basis as privately owned utilities, but the measure was defeated.

Charges Grand River Dam Level Increased Floods

Operation of project for power purposes increased downsteam flow. Major Gen. Robbins tells House Committee — Cites $500,000 damage to Oklahoma Ordnance Works — 754 level recorded

Major-Gen. Thomas Robbins, Deputy Chief of Engineers, told the House flood control committee this week that during recent floods along the Grand River in Oklahoma (ELECTRICAL WORLD, May 29, page 59; June 5, page 9) discharges into the river from Pensacola Dam were higher than would have existed under natural conditions without a dam.

Increases Downstream Levels

Unduly high levels in the dam, Robbins testified, increased downstream river levels for a week after the crest of the first flood early in May. Had the dam been operated for power at a pool level of 735 feet, as U. S. Engineers had insisted it be operated, Robbins went on, the advance warnings of the first flood given by the Weather Bureau would have allowed the dam to be lowered below 735 feet before the flood, which in turn would have cut discharges from the Pensacola Dam to levels well below those recorded.

As a result of the flood, Robbins testified, the $40,000,000 Oklahoma Ordnance Works, located between Pensacola Dam and the confluence of the Grand River near Muskogee, Okla., was shut down for three days and damage approximating $500,000 was done it. Preliminary estimates of the flood damage in the Arkansas River Basin by the Corps of Engineers total $20,000,000, Robbins said, adding that local interests estimated damages as high as $35,000,000.

Had the three-reservoir system, of which Pensacola was to be one unit, been installed as the Engineers and Congress wanted, Robbins said, the flood crest at Muskogee would have been cut 6.6 feet. Muskogee suffered two record-breaking flood crests within two weeks, testimony showed, with the second cresting at 48.2 feet, almost 10 feet above the first. Discharge at Muskogee, 9 miles down the Arkansas River from the mouth of the Grand River, was 670,000 cu.ft per second. Below Pensacola Dam the Grand River has a normal discharge ranging from 80,000 to 100,000 cu.ft. per second.

Maximum elevations at Pensacola Dam during the two floods were 751.32 feet and 754.58 feet for the first and second crests respectively, Douglas Wright, manager of the dam, testified. The dam is 755 feet high.

Under the questioning of committee chairman William M. Whittington, Mississippi Democrat, Wright testified that the dam was never operated above 745 feet, then admitted that it had been operated at 746 feet during last February, in accordance with dam policy to store up floodwater for dry season operation. Robbins had said he was informed that the plan was to operate at 747.5 feet whenever possible.

Wright told the committee that he had received a warning of heavy rains above the dam May 7 and then had been notified May 9 that the rains had stopped short of creating floods. Whittington then asked Wright whether he had not received another warning May 9 that rains had begun again, which Wright admitted having received. Before the first flood started, Wright said, the dam was operating at 744.4 feet. As the river rose, the dam level was raised to hold back about 100,000-second-feet of the flood, Wright said. Between floods there was not time to get the dam below the 745.3-foot level at which it entered the second flood, Wright declared, adding that any greater discharge would have severely flooded the Arkansas River and that he lowered it to that point under protests of farmers.

Income Figures Given

Income from power at 735 feet, Wright testified, would be $800,000 yearly, insufficient to allow the project to operate economically. The 745-foot power pool allows a gross annual income of $1,700,000. Costs are about $300,000 yearly.

Major-Gen. Philip B. Fleming, Federal Works Administrator, whose agency operates Pensacola Dam, testified that the dam's generating facilities are operating at capacity, with "system losses only 3 per cent of the power generated," a record which I believe is unexcelled anywhere in the country." This efficient operation, he said, followed near bankruptcy in the fall of 1941, when "its power was far from being fully utilized in the defense effort."

U. S. Free From State Control, Court Declares

Further clarification of the subject of federal government immunity from state regulation was provided last week with the decision of the U. S. Supreme Court which reviewed the action of a Florida district court in enjoining the Commissioner of Agriculture of Florida from enforcing against the United States the provisions of the Florida Commercial Fertilizer Law. Under the Florida act, distribution or sale of commercial fertilizer is comprehensively regulated. As part of a national soil conservation program, the government undertook to distribute fertilizer in Florida recently, without complying with the state regulations requiring a stamp or label as evidence of payment of an inspection fee. Distribution was stopped by Florida officials and the U. S. took the case to court.

The court decided that the U. S. was the owner of the fertilizer in Florida awaiting distribution. Admittedly, they said, the state inspection service is to protect consumers from fraud, but in carrying out such protection the federal function must be left free. This freedom, the court said, is inherent in sovereignty. Where governmental action is carried on by the United States itself and Congress does not affirmatively declare its instrumentalities or property subject to regulation or taxation, the inherent freedom continues, the court declared.

•

Joe Weiner Resigns From OCR

Chairman Donald M. Nelson of WPB has announced his acceptance of the resignation of Joseph L. Weiner, who had served as assistant to Arthur Whiteside, director of the Office of Civilian Requirements. Weiner asked that the resignation become effective June 14.

Weiner, formerly with the Securities and Exchange Commission, became assistant administrator and director of Civilian Supply in the old office of Price Administration and Civilian Supply under Leon Henderson in May, 1941. When Civilian Supply was separated from Price Administration, Weiner went along as deputy director and was made director of OCS last December following Henderson's resignation. He stayed on as an assistant to Whiteside when OCS was abolished and OCR established two months ago.

Close friends of Weiner said he did not plan to return to his old position as director of SEC's public utilities division, but that he planned rather to enter private practice of law.

•

U. S. Engineers Consider New Snake River Dam

A barrier almost as high as Boulder Dam, blocking the Snake River in its deep canyon 49 miles upriver from Lewiston, Idaho, was recently reported being contemplated by the U. S. Army Engineers as a post-war project to generate 1,000,000 kw. of electric energy.

Col. Donald J. Leehey of Portland, Ore., district Army Engineer, has been quoted as saying that preliminary studies "have indicated the desirability of a storage reservoir on the Snake River below the mouth of the Salmon. In line with present-day engineering technique, it is probable that such a reservoir would be created by a dam in the neighborhood of 600 ft. in height."

MEETINGS

Northwest Electric Light & Power Association—Accounting and business practice section, Seattle, Wash., June 14-15. Berkeley Snow, secretary, 418 Spalding Bldg., Portland, Ore.

American Society of Agricultural Engineers—Annual meeting, Purdue University, Lafayette, Ind., June 21-23. Raymond Olney, secretary, St. Joseph, Mich.

Previously Listed

American Society of Mechanical Engineers—Semi-annual meeting, Hotel Biltmore, Los Angeles, Calif., June 14-16. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York, N. Y.

Canadian Electrical Association—Annual meeting Seigniory Club, Quebec, June 17-18. B. C. Fairchilds, secretary, 804 Tramways Bldg., Montreal, Que.

Society for Promotion of Engineering Education—Annual meeting, Illinois Institute of Technology, Chicago, Ill., and Northwestern University, Evanston, Ill., June 18-20. F. L. Bishop, secretary, University of Pittsburgh, Pittsburgh, Pa.

American Institute of Electrical Engineers—National technical meeting, Hotel Cleveland, Cleveland, Ohio, June 21-25. H. H. Henline, national secretary, 33 W. 39th St., New York, N. Y.

Public Utilities Advertising Association—Annual meeting, Edgewater Beach Hotel, Chicago, Ill., June 24-25. Waldo M. Wright, secretary, Amarillo Gas Co., Amarillo, Texas.

American Society for Testing Materials—Annual meeting William Penn Hotel, Pittsburgh, Pa., June 28-July 1. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

International Association of Electrical Inspectors—Northwestern section, New Washington Hotel, Seattle, Wash., August 26-27; F. D. Weber, secretary, P. O. Box 70, Portland, Ore. Southwestern section, Los Angeles, Calif., week of August 30; H. L. Gerber, secretary, Room 205, City Hall, San Francisco, Calif. Western section, LaSalle Hotel, Chicago, Ill., September 13-15; F. H. Moore, secretary, 320 N. Meridian St., Indianapolis, Ind. Eastern section, New York, N. Y., week of September 20; F. N. M. Squires, secretary, 85 John St., New York, N. Y. Southern section, Roosevelt Hotel, New Orleans, La., September 27-29; C. M. Jones, secretary, 307 Trust Co. of Georgia Bldg., Atlanta, Ga.

REA Co-op Funds of $1,790,000 Allocated

Allocations totalling $1,790,000 to 20 REA cooperatives in 18 states were approved recently by the Agriculture Department. Funds will be used to finance facilities already completed in accordance with WPB regulations, to acquire existing properties and to extend service to more than 1,000 farms producing livestock, dairy and poultry products.

It was emphasized that new construction will be undertaken only in accordance with WPB regulations. Acquisition of some existing facilities will facilitate electrification of additional farms after the war.

The latest allocations bring the year's total grants to $5,514,550 and the overall total to $464,235,465.

•

Northwest Utilization Conference at Portland

The utilization section of the Northwest Electric Light and Power Association will meet in one of its streamlined war conferences at the Multnomah Hotel, Portland, Ore., June 11 and 12, according to J. C. Plankinton, Northwestern Electric Co., chairman. This is the second conference held in the past six months and it will be devoted to a discussion of utility operations under wartime conditions.

Discussions are conducted in round-table manner with a discussion leader assigned each subject, and acting in this capacity are A. H. Wegner, Washington Water Power Co.; D. B. Leonard, Pacific Power & Light Co.; J. M. McKay, Portland General Electric Co.; R. B. McElroy, Washington Water Power Co.; R. E. Gale, Idaho Power Co.; J. B. Buman, Northwestern Electric Co., and C. E. Hess, Puget Sound Power & Light Co.

•

New Zealand Curbs Use of Electric Power

The government of New Zealand recently announced new measures cutting the winter use of electric power. The Supply Ministry set limitations on the use of all electricity in luxury or non-essential groups, banning radiators except in homes during the early evening hours, May through September, and ending exterior lighting except for community purposes. Store window lighting is also restricted.

Holiday Week Output Drops

The holiday-shortened Decoration Day week ended June 5 brought a drop in the output curve for the first time since the first May week. Electric energy distributed by the light and power industry totaled 3,925,893,000 kw.-hr., as compared to 3,990,040,000 kw.-hr. the previous week and 3,992,250,000 kw.-hr. during the week ended May 22. Figures for the latest week represent an increase of 16.4 percent over the figures for the corresponding week in 1942, according to the Edison Electric Institute.

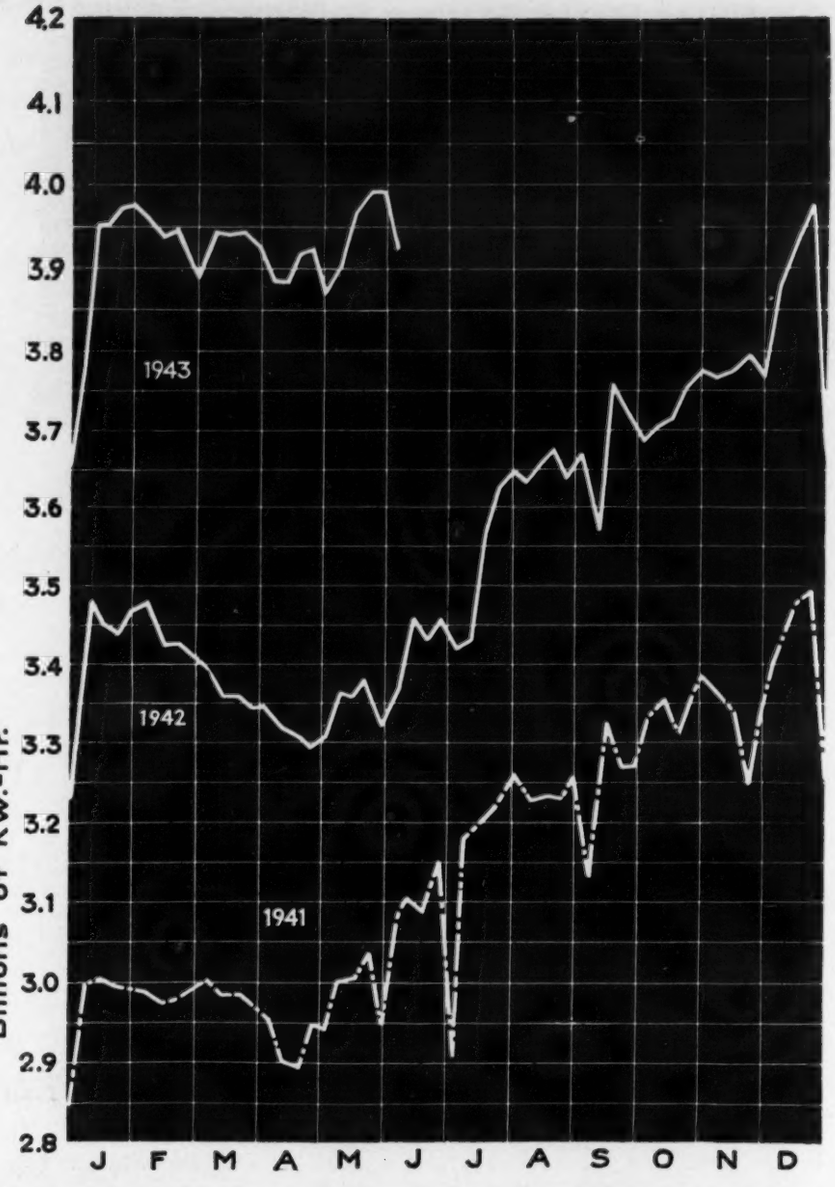
Only one section of the country—the Rocky Mountain region—showed a percentage gain for the latest week over the previous week. All other sections reported impressive decreases. The Pacific Coast, with a 28.6 percent gain over the '42 figures, continued to lead the country, with the Southern states second.

Weekly Output, Millions Kw.-Hr.

1943		1942		1941	
June 5	3,926	June 6	3,372	June 7	3,076
May 29	3,990	May 30	3,322	May 31	2,955
May 22	3,992	May 23	3,380	May 24	3,040
May 15	3,969	May 16	3,357	May 17	3,011
May 8	3,904	May 9	3,365	May 10	3,001
May 1	3,867	May 2	3,304	May 3	2,945
Apr. 24	3,925	Apr. 25	3,273	Apr. 26	2,950
Apr. 17	3,917	Apr. 18	3,708	Apr. 19	2,897
Apr. 10	3,882	Apr. 11	3,321	Apr. 12	2,905
Apr. 3	3,890	Apr. 4	3,348	Apr. 5	2,959

Percent Change from Previous Year

	Week Ending		
	June 5	May 29	May 22
New England	+ 5.0	+12.2	+ 9.3
Mid-Atlantic	+14.6	+20.2	+16.3
Central Industrial	+11.8	+16.4	+16.7
West Central	+10.7	+11.2	+11.4
Southern States	+21.3	+22.4	+17.8
Rocky Mountain	+19.2	+15.9	+16.4
Pacific Coast	+28.6	+33.4	+31.9
Total United States..	+16.4	+20.1	+18.1



Protect Civilian Supply of Radio Tubes

WPB has amended Order L-265 to prevent the armed services and holders of rated orders from depleting the civilian supply of radio tubes.

Under the new procedure, manufacturers of civilian tubes will stamp "MR" on their output. These tubes may not be transferred to major claimant agencies or holders of rated orders. Civilians need no ratings. Their supplies will be replenished at the dealer level by certification that all "MR" tubes sold went for maintenance and repair of civilian sets.

WPB warned that civilian production of tubes is fitted into schedules for claimant agencies and for rated orders, that it is low and that requirements for some types of tubes are not being met. In the past, some tubes made from materials allocated for civilian use have been diverted to fill orders by the services or other priority holders.

•

Utility Service Motor Vehicles Get Gas

Local Office of Price Administration executives may include utility service motor vehicles in the list of those eligible for special gasoline purchases in gasoline shortage areas.

To assure that vital public services have sufficient motor fuel, OPA has established a procedure under which local OPA officials may designate certain service stations or facilities in shortage areas which must give special preference in gasoline sales to vital services. Such designations must be approved by the OPA Deputy Administrator in Charge of Rationing.

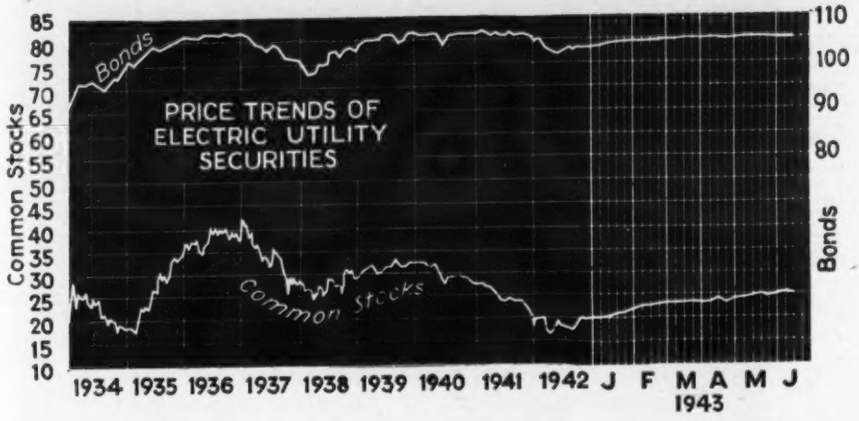
While utility vehicles would not be eligible for this special service without specific authorization by both local and Washington officials, OPA ruled that, because of the vital character of utility service, service vehicles may be included when necessary.

•

Reject Utility Purchase

Voters of Safford, Ariz., who defeated a proposal a year ago for municipal purchase of the Arizona General Utilities Co., rejected the plan again last month. The vote was 231 against the purchase and 196 in favor of it. Purchase of the company would have cost the city $455,000.

Utility Stocks Decline; Bonds Hold Firm



While there were few changes in electric light and power stocks during the past week, the "Electrical World" index dropped to 25.1 from 25.4; last year, 18.7. Bonds held firm at 105.7; last year, 102.8

SEC Power Upheld By Supreme Court

The U. S. Supreme Court recently upheld the broad authority of the Securities and Exchange Commission in determining what constitutes a subsidiary under the Holding Company Act. In refusing to review a lower court decision that the American Gas & Electric Co. should be classified as a subsidiary of the Electric Bond & Share Co., the court, in effect, upheld the commission's interpretation of "controlling influence" in the determination of what constitutes a subsidiary.

Importance of Decision

The importance of the decision may be ascertained from the following facts:

The so-called "death sentence" provisions of the Holding Company Act require each registered holding company "and each subsidiary company thereof," to take whatever action the commission finds necessary to limit their operations to "a single integrated public utility system." The act further provides that if more than 10 percent of a company's outstanding voting securities are held by a holding company, the former is a subsidiary of the latter unless the commission, upon application, finds an absence of control.

Electric Bond & Share owns 17.51 percent of the outstanding voting securities of American Gas & Electric and has two representatives on the latter's board of 15 directors. In addition, Bond & Share has one of its members on the executive committee, comprising five members, of American Gas. Bond & Share has maintained that it had nothing to do with the management or operational policies of American Gas. American Gas filed application with the commission asking for an order declaring it was not a subsidiary. The commission held, however, that American Gas was subject to "controlling influence" and denied the application. The Court of Appeals for the District of Columbia upheld the ruling and the Supreme Court, in denying review of the lower court decision, upholds the SEC's power to determine the nature of a subsidiary operation.

•

Penelec Seeks to Buy Erie

Pennsylvania Electric Co. has filed application with the Federal Power Commission for authorization to acquire all the utility assets of the Erie County Electric Co.

According to the application, Penelec proposes to acquire from the United Gas Improvement Co., parent of Erie, all the stock of Erie at a total cost to Penelec of $6,921,500 with a further contingent cost to Penelec of a sum not in excess of $215,559. Following the acquisition of the Erie stock, Penelec proposes to acquire all the assets and franchises of Erie in consideration of the surrender of such stock by Penelec for cancellation and the assumption of the obligations of Erie.

Penelec proposes to raise the funds to consummate the transaction by issuing and selling to Associated Electric Co., parent of Penelec, 171,075 shares of common stock of Penelec for $3,421,500 in cash and by issuing and selling competitively 35,000 shares of cumulative preferred stock of Penelec.

The Erie facilities consist of one steam-electric generating station with rated capacity of 34,000 kw., limited by boiler capacity to 21,500 kw.; 35.6 miles of overhead transmission lines of 13,200 volts and 6.5 miles of underground line of 13,200 volts; one transmission substation with capacity of 20,000 kva. and 15 distribution substations with aggregate capacity of 24,875 kva.; 517.1 pole miles of overhead distribution lines and 36.34 miles of underground distribution lines, and 2,205 distribution transformers with an aggregate capacity of 36,257 kva.

•

South Carolina Merger Approved

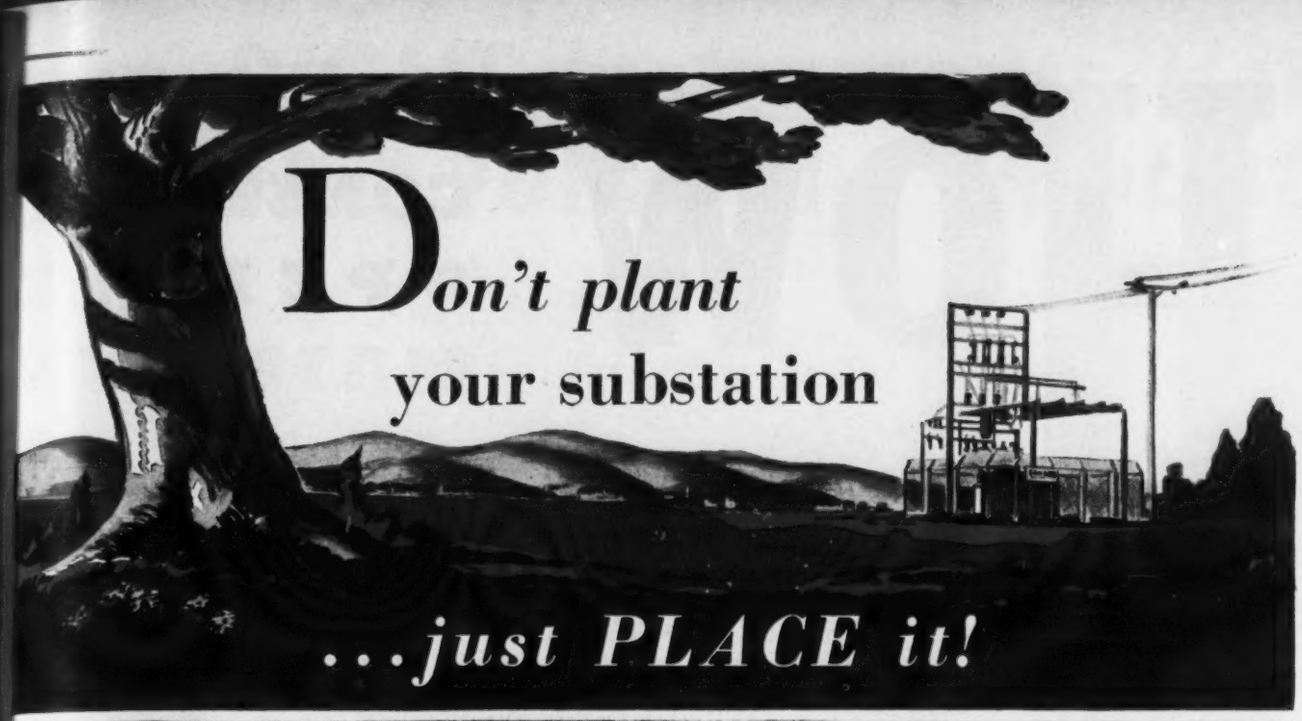
The Federal Power Commission has announced its orders (1) authorizing the merger and consolidation of facilities of the Lexington Water Power Company into the South Carolina Electric & Gas Company, and (2) approving the transfer of a license, as amended, issued to the Lexington company for a period extending from August 5, 1927, to August 4, 1977, covering a hydro-electric project (No. 516) on the Saluda River, in Lexington, Richland, Newberry and Saluda counties, South Carolina. Both companies are controlled by General Gas & Electric Corp., a subsidiary within the Associated Gas & Electric System.

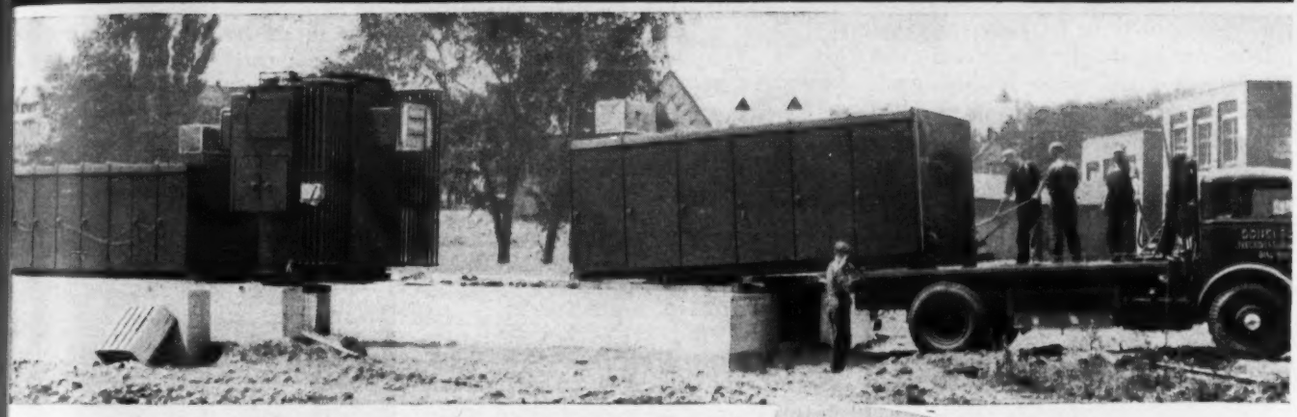
In considering the effects of the merger on the public interest, the order points out that: "The proposed merger and consolidation of facilities of Lexington company subject to the jurisdiction of this commission into South Carolina company, as hereinafter authorized and approved, will tend to advance the integration of the facilities and result in simplification of the corporate structure of applicants."

Utility Reports

	Net Income 1943	1942
*American Light & Traction and subs	$5,759,241	$6,177,681
†Arkansas Power & Light	1,236,532	2,013,271
*Associated Gas & Electric and subs	9,391,250	7,699,223
†Dallas Power & Light	1,491,803	1,687,407
†Engineers Public Service and subs	4,601,697	4,489,078
*Federal Light & Traction and subs	1,148,910	1,066,938
†Iowa Southern Utilities	406,712	534,551
†Louisiana Power & Light	1,349,996	1,053,744
†Mississippi Power & Light	795,197	538,586
†New Orleans Public Service	2,318,334	2,166,339
†Northwestern Electric	692,554	525,810
*Standard Gas & Electric and subs	5,780,914	3,725,316
†Utah Power & Light and subs	1,965,487	1,912,454

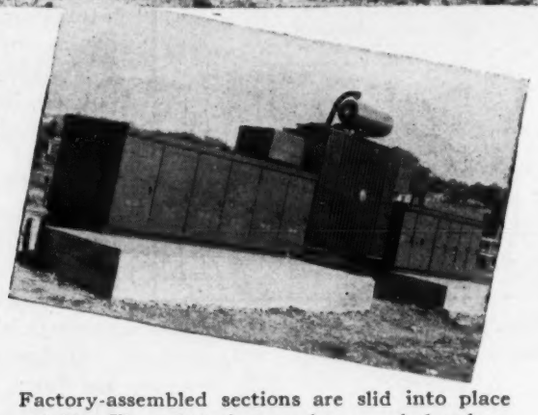
*Twelve months ended March 31.
†Twelve months ended April 30.





UNIT SUBSTATIONS

are quickly installed and easily moved



Factory-assembled sections are slid into place quickly. The substation can be moved elsewhere just as easily, should it become desirable.

WAR-PRESSED utilities and industrials are greatly accelerating the already-strong trend from *piecemeal* to *unit* substations—from *planting* a substation piece by piece to *placing* it as a unit. Unit design means quick installation, and it means you can easily move your substation to follow load shifts.

Actually, the advantages of unit substations begin with their selection. You can select a complete, standard substation as one unit, order it with a simple functional specification, and have it shipped—*factory assembled*—weeks sooner than would be possible for a piecemeal assembly.

Then, by installing these compact, safety-enclosed units right at load centers, you can greatly shorten secondary runs, save precious copper by the ton.

Finally, you have a *co-ordinated* substation—every part designed to fit and function with every other part. Engineers see the benefits in remarkable service records. And everyone appreciates the vastly improved appearance, which gives greater flexibility of installation in urban areas.

Our attractive, new 36-page bulletin will give you useful information. Ask your G-E office for GEA-3800 or write direct to General Electric, Schenectady, N. Y.

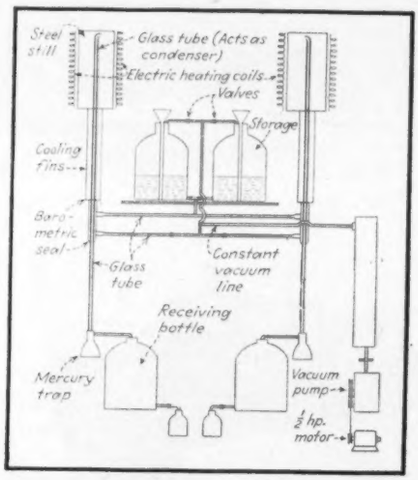
GENERAL ELECTRIC

302-16-590C

HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

Home-made Still Purifies Mercury

A home-made still for purifying mercury, used in mercury-arc rectifiers, can be simply made from glass tubes, jars and other readily available materials. Such a still made in the Westinghouse Electric & Manufacturing Company, East Pittsburgh



SKETCH of home-made still for distilling mercury

works, delivers mercury 99.99 percent pure and will handle a quantity of 400 lb. per day.

In order to assure continuous operation, the still was made in two sections—either of which may be shut off while the other is kept in operation. This arrangement is necessary for cleaning operations.

As indicated on the sketch, the glass tube which carries the pure mercury down to the receiving bottle acts as a condenser.

By maintaining barometric heights on both the feed and the discharge lines, the still vacuum seals itself so that all the operator has to do is fill the feed bottles and empty the discharge bottles twice a day. The still is entirely automatic in its operation.

•

Acid Number of Oil Found by Field Test

By H. L. BRIGGS *
Assistant Chief Engineer
Winnipeg Hydro-Electric System,
Winnipeg, Canada

The acid neutralization number of a transformer oil is determined readily in the field by the Winnipeg Hydro-Electric System, Winnipeg, Canada, if the value is within a predetermined range. The method was developed in collaboration with Messrs. Blackie and Phillips, consulting chemists, and is sufficiently simple to enable a field test man easily to eliminate from consideration those oils which contain no harmful amounts of acid.

Equipment and materials required are few: (1) A number of 4-oz. (113 cc.) oil sample bottles with corks, (2) several 500-cc. pyrex stock-solution stoppered-bottles containing (3) a standardized solution of potassium hydroxide (KOH) in phenolphthaleinized methanol (CH_3OH), (4) some commercial methanol, and (5) a warming oven or location to maintain 85-115 deg. F. overnight.

For simplicity, measurements are volumetric rather than by weight. Since the specific gravities of the oils tested vary from 0.83 to 0.89, the test quantities are made up for the single specific gravity of 0.86.

Test Procedure

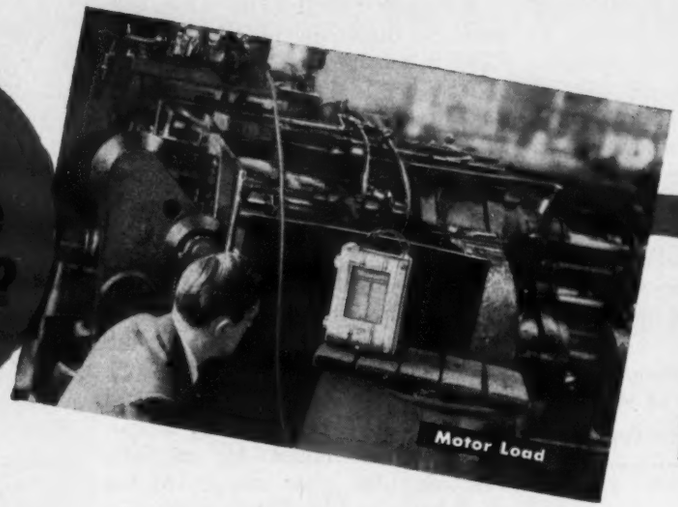
The oil to be checked is sampled as if for a potential test. It is filled to the 65 cc. level in an oil sample bottle provided with 65 cc., 80 cc. and 95 cc. graduations. The standardized KOH solution is added to the 80 cc. mark, the cork replaced, and the mixture well agitated before leaving it for separation in the warming oven overnight. If then a trace of pinkish color remains in the upper portion, the acid number is below 0.2, but if the color is entirely discharged the same test cycle is repeated after adding KOH solution to the 95 cc. mark. If indicator color

FIELD KIT for acid neutralization test of oils

*Abstract of a paper presented before recent conference of Doble Engineering Company clients, Boston, Mass.

The RIGHT Instruments Help Get the Jump on TROUBLE

How Would You Handle these 3 Jobs?



1 **MOTOR LOAD** is being analyzed with a G-E portable inkless recorder. The test is made *without interrupting production,* simply by using a split-core current transformer (clamped around a lead in the control cabinet) connected to the recording ammeter.

2 **FEEDER CIRCUITS** are being checked with the G-E hook-on volt-ammeter. Both current and voltage are measured with just *one* instrument, simply by flicking the selector switch, first to AMPS and then to VOLTS.

3 **MOTOR-STARTING CURRENT** is being determined quickly by means of a G-E pointer-stop ammeter. An oscillograph could be used, but it is easier to use this instrument—particularly when there are a large number of motors to be checked.

These are typical examples of using the RIGHT instrument to get electric-circuit information in a hurry, without interrupting production. Have you the RIGHT ones for your preventive maintenance? This is particularly important if you have green hands in your maintenance department.

5 Instruments Will Do 90% of Most Testing Jobs

The G-E instruments shown below will handle most of your testing. Prices are for estimating only. For details, ask the nearest G-E office for the bulletins listed. If you need other instruments, let us know. *General Electric, Schenectady, N. Y.*

WHICH OF THESE TESTING INSTRUMENTS DO YOU LACK?

A-C HOOK-ON VOLT-AMMETER. The handiest of instruments for quick load checks —no cutting conductors or interrupting service. Measures volts also. Bulletin GEA-2950.

MEDIUM-SIZE PORTABLE, A-C (AND DP-9, D-C). Accurate within ¾ of one per cent. Very portable—size only 2½ by 4¾ by 6½ inches. Price covers a 5-amp ammeter. Bulletin GEA-1784.

POCKET-SIZE PORTABLE, A-C (AND DS-5, D-C). Accurate within one per cent. Slips easily into a coat pocket—size 2 by 3¾ by 5½ inches. Price covers a 5-amp ammeter. Bulletin GEA-1784.

INKLESS RECORDER, PORTABLE. An inexpensive instrument. Inkless—no pen to start and no ink to spill. Price covers a 5/10-amp ammeter. Bulletin GEA-3187.

INK RECORDER, PORTABLE AND SWITCHBOARD. Ideal for use where a high degree of accuracy is very important. Price covers a 5-amp portable ammeter. Bulletin GEA-1061.

GENERAL ELECTRIC

is then present, the acid number of the oil is below 0.4; if it is discharged the acid number is above this value and a fresh sample of oil is sent to the laboratory for precise determination.

To settle any doubt as to whether indicator pinkness is present after a test run, a color blank is often helpful. It is made from a second 65 cc. sample of the oil by adding commercial methanol to the same final level, then giving the original and the blank the same treatment to completion.

Procedure and values given are based on the decision to take remedial action when the oil in an important transformer has an acid neutralization number above 0.7.

Still maintaining the advantage of using only one strength of standard caustic solution, both the method and the equipment are satisfactory for running five tests simultaneously for 0.1, 0.2, 0.3, 0.4 and 0.5 acid neutralization numbers.

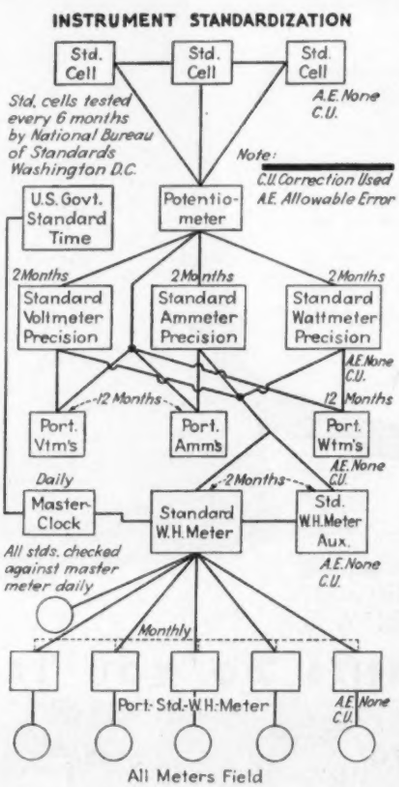
The standardized KOH solution is made by dissolving chemically pure KOH in enough phenolphthaleinized doubly distilled methanol to provide the degree of alkalinity required for the sampling measurements given. It is made up in and obtained from a laboratory as required.

Precautions

For obvious reasons, care is required to prevent contamination from whatever cause. In addition, the stock solution will be affected by (1) evaporation, (2) carbon dioxide and (3) action on glass container. Evaporation is minimized by carefully vaselining the glass stopper of the stock bottle and by closely stoppering both stock and test bottles. When bottles are open breathing near them must be avoided. Destandardization of stock solution will be reduced if the KOH solution is obtained in dated bottles whenever required, returning to the laboratory any issued more than two months previously.

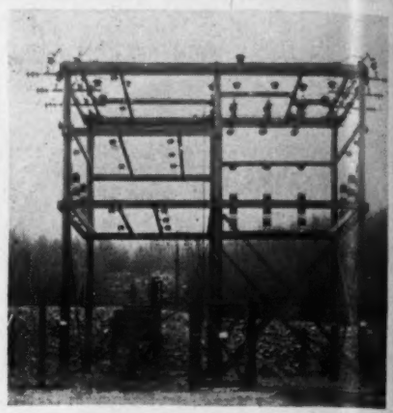
Oil sample bottles may be stored filled with distilled water, provided they are washed with fresh distilled water and well shaken out before use.

Instrument Standardization Procedure



Charted, above, are steps in the procedure followed by the Dallas Power & Light Company meter laboratory in checking field standard instruments and meters against laboratory primary and secondary standards. Frequency with which the tests are made is indicated in each case on the diagram.

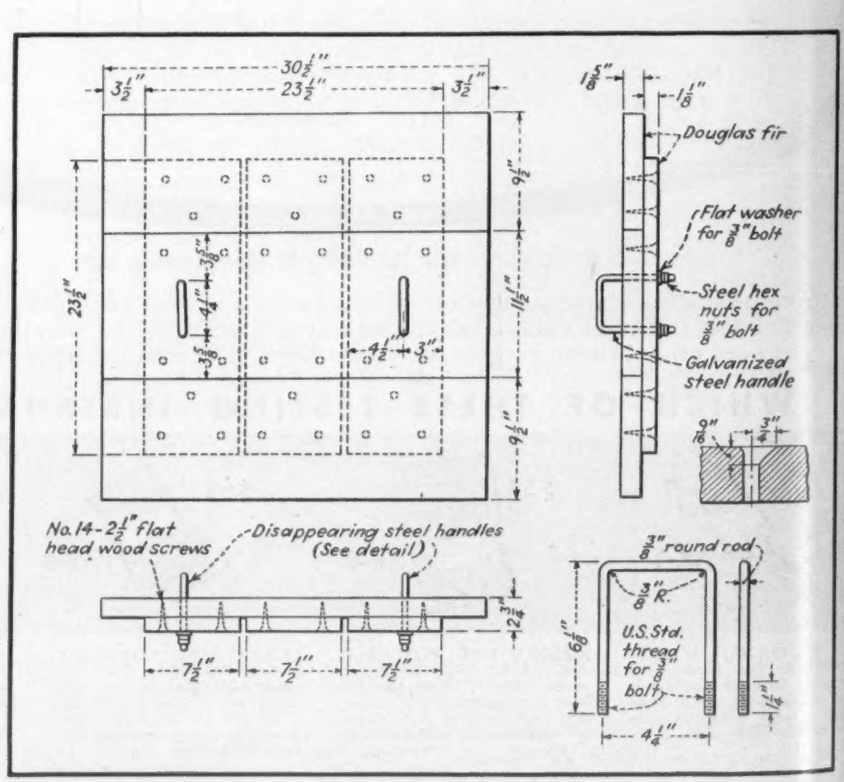
Simple Switching and Metering Station



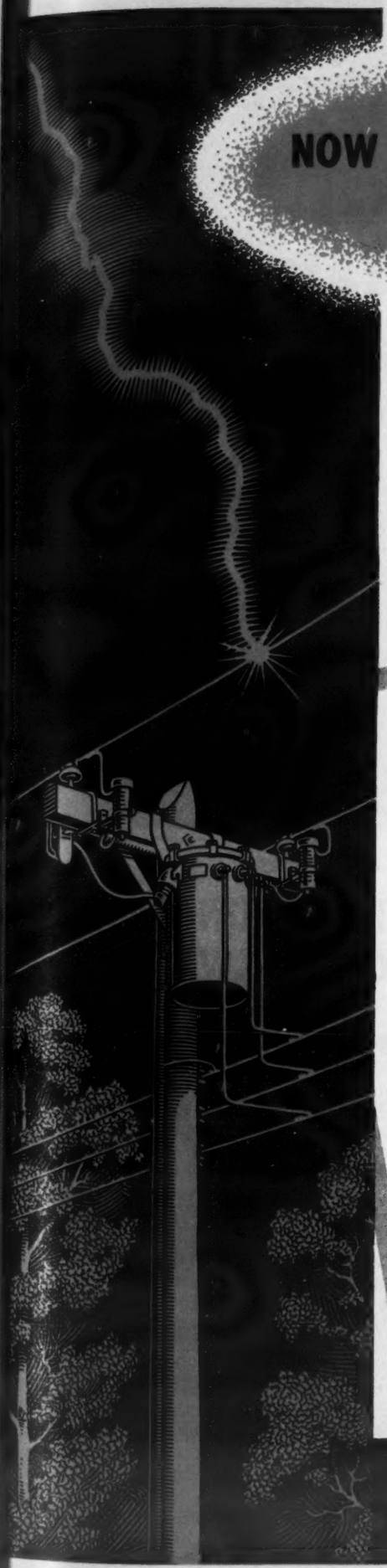
Loop line of Orange & Rockland Electric Company, Monroe, N. Y., broken by 33-kv. switching station, entirely of wood, to meter and serve 5,000 hp. load of reopened iron mine in northeastern New Jersey over a 5-mile line of 4 A Copperweld conductors.

Wood Replaces Metal for Manhole Covers

Wood manhole covers of the type shown are being substituted in Milwaukee for cast covers in substation



ASSEMBLY of cover and detail of handle and notch for handle



NOW Reliable Lightning Protection Is More Important Than Ever

1. It preserves investments in costly or unreplaceable electric equipment.
2. It protects new or old apparatus from damage and keeps it in service.
3. It reduces repair or replacement demands involving vital materials.
4. It prevents interruptions of indispensable power service to consumers.

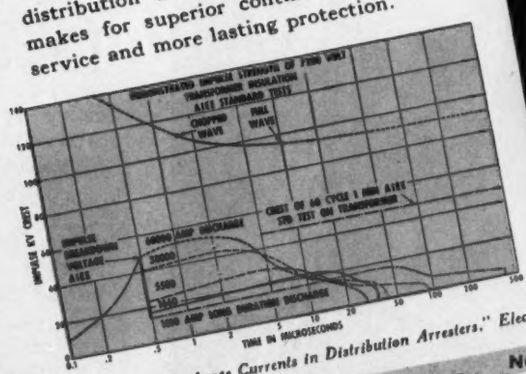
ON DISTRIBUTION LINES
You can be sure of adequate protection with G-E pellet arresters

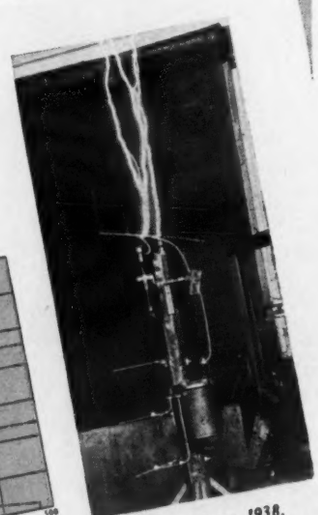
BECAUSE

1. **Pellet arresters limit stresses to less than half the impulse strength of the distribution transformer, even with severe lightning discharges.** (In the graph below, the impulse volt-time oscillograms of the 9-kv pellet arrester are compared with the volt-time impulse test strength of a 7200-volt distribution transformer. No other distribution protective device assures such a large margin of protection.)

2. **Pellet arresters have large discharge capacity.** Pellet arresters withstand severe lightning strokes. They have discharge capacity in excess of the highest lightning discharge currents measured on distribution circuits.*

3. **Pellet arresters have valve action.** The best arresters ever made—those used for protection of the most costly power apparatus—have always been of the valve type. In distribution arresters, too, valve action makes for superior continuity of power service and more lasting protection.





*See "Discharge Currents in Distribution Arresters," Electrical Engineering, June, 1938.

NO NEED TO GAMBLE
Select your G-E pellet arrester from Bulletin GEA-2975. General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

Watch Out

FOR "LIVE-WIRE ENTANGLEMENTS" IN YOUR PLANT

PROTECT PERSONNEL AND PRODUCTION WITH . . .

Safety-enclosed Switchgear

DANGEROUS "spiderweb switchgear" like this originates as strung-out, open-type switchgear, and grows more dense and more dangerous every year that additional devices are added. It often adds up to power interruptions and accidents to personnel.

That's why compact, safety-enclosed switchgear is going not only into today's new and enlarged plants but also into scores of existent plants to replace exposed, open-type assemblies. Industry knows that its job is far too big—and its man power too precious—to trust in haphazardly exposed devices.

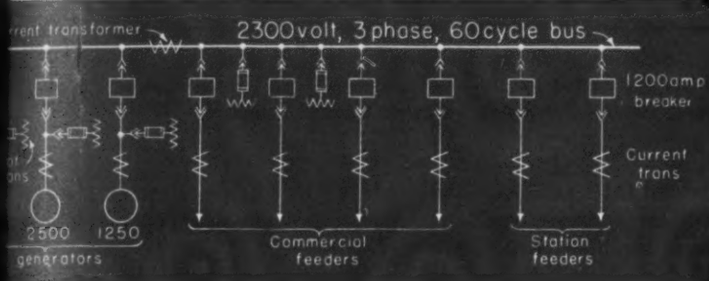
Today you can select, order, and install safety-enclosed switchgear in less time than ever before, because General Electric has ***standards*** to fill your needs. Standard load center unit substations, too, consisting of ***metal-enclosed*** switchgear and ***Pyranol*** transformers. Scores of war plants have kept in step with swelling power needs by installing these safe, compact, factory-assembled units instead of dangerous open-type assemblies. They give you long-term safety and dependability—save tons of vital copper.

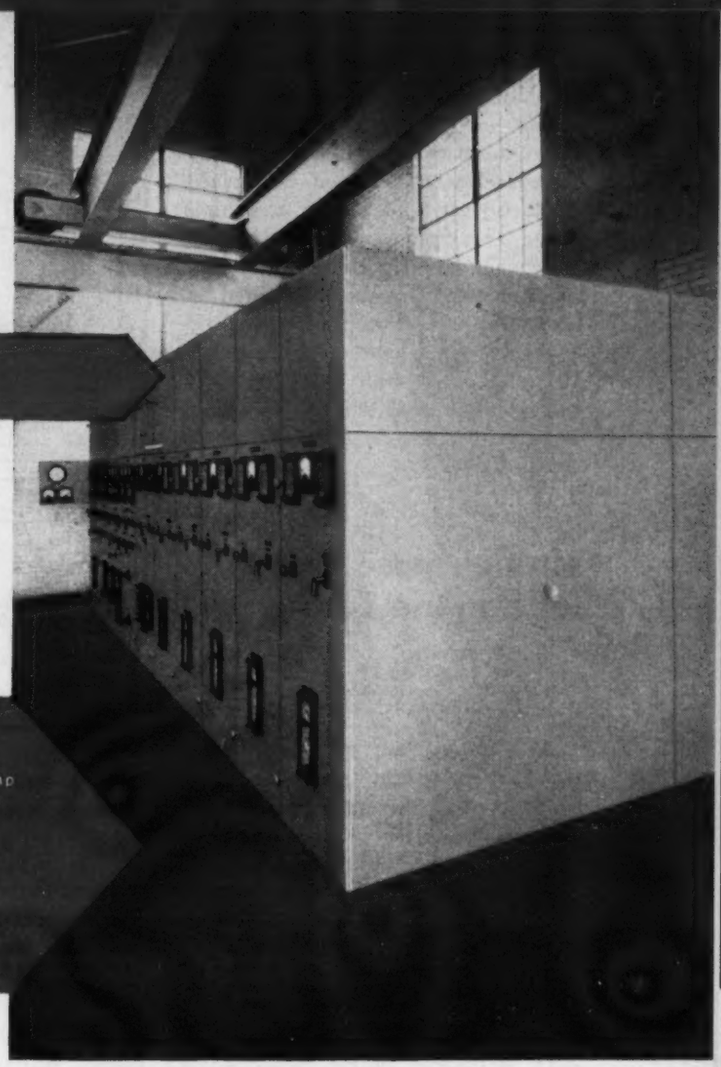
THIS DANGEROUS AISLE LINED WITH LIVE COPPER WAS WIPED OUT . . . .

. . . WHEN THIS MODERN SAFETY-ENCLOSED SWITCHGEAR WENT IN

. . . because metal-clad includes breakers and all associated equipment—instrument transformers, buses, and connections—in one safe, compact "package."

This simple, one-line diagram enabled us to put our switchgear factory right to work on the safety-enclosed units shown at the right.





SAFETY-ENCLOSED UNITS LIKE THESE CAN BE INSTALLED . . . *QUICKLY*

With the one-line diagram of the electric system, General Electric engineers helped select *standard* switchgear that filled every requirement. It took a relatively short time to manufacture the standard units. They were shipped complete—on arrival, they had only to be set in place and connected.

The modern metal-clad switchgear with vertical-lift breakers took over the load, the old open-type apparatus was removed, and power was continued without interruption.

Safety-enclosed unit substation, including Pyranol transformer and drawout air breaker equipments, installed indoors at a load center.

. . . AND WITH TONS LESS COPPER

These metal-clad switchgear units took only 47 pounds of copper each—less than one-fourth as much as open-type assemblies for the same job. This is because compact, metal-clad construction does away with the many long, strung-out copper interconnections of open-type switchgear—replaces them with a few short ones. Also because copper disconnecting switches like those on the opposite page are entirely eliminated by modern, vertical-lift breakers that can be quickly and easily connected and disconnected from the main buses.

Unit Subs Save Still More Copper

What's more, you can save immense amounts of cable copper by installing safety-enclosed unit substations—including *metal-enclosed* switchgear and *Pyranol* transformers—right at the center of the load area. Power can then be distributed to load centers at relatively high voltage. This means *short* secondary cables—and tons of copper saved.

Ask the nearest G-E office about *standard* G-E switchgear and unit substations. You can save time and copper, and get a new high degree of operating dependability and safety. ***General Electric, Schenectady, N. Y.***

GENERAL ELECTRIC

yards, on private property, and other non-traveled areas. Metal covers so released are used as replacements on traveled streets and highways. The design, developed by the Wisconsin Electric Power Company, uses creosoted Douglas fir, treated before assembly. Fitted with two disappearing steel handles, the cover is 30½ x 30½ in. overall by 2¾ in. thick and is made up of two thicknesses of wood with the axis of the grain at right angles.

•

Multipurpose Forms for Routine Tests

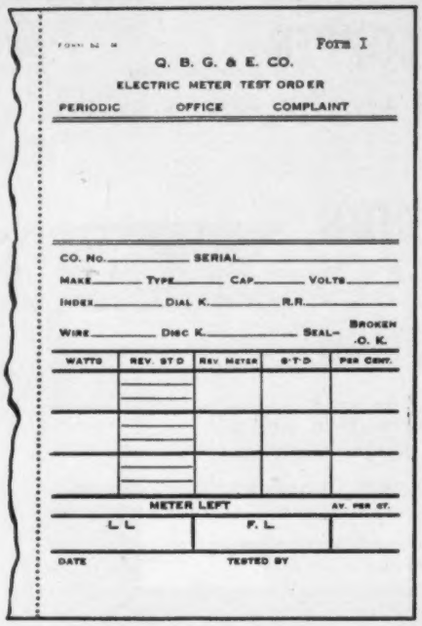
By H. F. WAGNER
Superintendent of Meters
Queens Borough Gas & Electric Company
Far Rockaway, N. Y.

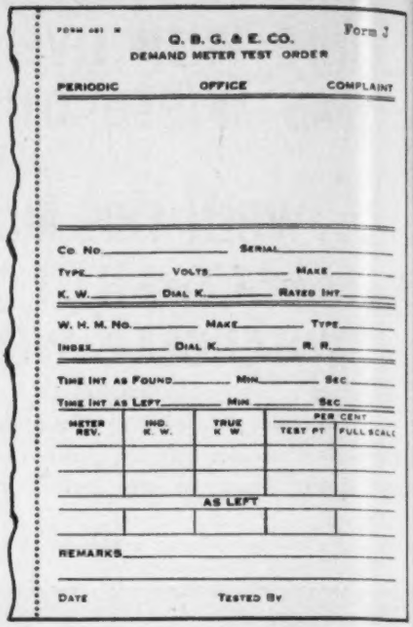
A standardized meter test and record form (Form I) is used for all tests, those which originate from customers' complaints, for company operations and periodic. The company's plant property department originates all periodic meter test orders. This department maintains all test and meter records on machine accounting cards (Form H) compiled from duplicate test reports and data furnished by the meter shop. Periodically, the meter cards (Form H) are sorted by size and kind according to period of test required by the P.S.C. They are then sorted by month and year of last test, those due for test being segregated. After further sorting, these are listed by district, route and folio number. The lists are sent to the addressograph department, where the blank orders are stamped with the proper plate. This procedure is particularly necessary due to seasonal conditions, to determine "active" accounts. They are then transmitted to the meter shop, being in the correct order for economical routing in the field.

Meters with demand registers are separately listed and are handled the same as other meters except that, in addition to the meter test order, the addressograph department also prepares a demand register test order (Form J).

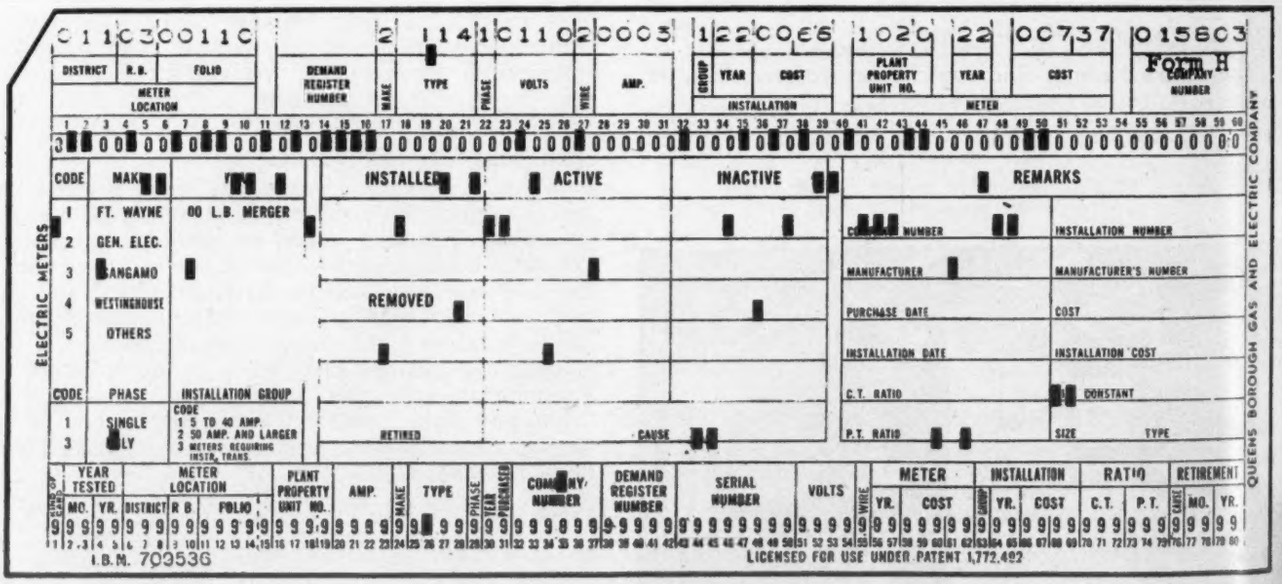
After execution, the duplicate copy of the test order is routed through the plant property department so that the information on the new test date may be recorded on the meter card.

All originals of these reports, meter records and historical data are kept on file in the meter shop. A heavy manila 3 x 5-in. folder is used, filed numerically as to assigned company meter number.


Form I
Q. B. G. & E. CO.
ELECTRIC METER TEST ORDER
PERIODIC OFFICE COMPLAINT
CO. NO. SERIAL
MAKE TYPE CAP VOLTS
INDEX DIAL K. R.R.
WIRE DISC K. SEAL BROKEN O. K.
WATTS REV. STD Rev. Meter S-T-D PER CENT.
METER LEFT AV. PER CT.
L L F. L
DATE TESTED BY


Form J
Q. B. G. & E. CO.
DEMAND METER TEST ORDER
PERIODIC OFFICE COMPLAINT
Co. No. Serial
Type Volts Make
K. W. Dial K. Rated Int.
W. H. M. No. Make Type
Index Dial K. R. R.
Time Int As Found Min Sec
Time Int As Left Min Sec
METER REV. IND K. W. TRUE K. W. PER CENT TEST PT FULL SCALE
AS LEFT
REMARKS
Date Tested By

TEST REPORT CARDS serve as flag for periodic routine test of meter. Each is folded along perforations for carbon record on duplicate printed on the reverse. (Left) For watt-hour meters. (Right) For meters carrying demand registers



PUNCH CARD in plant property prompts sending addressographed blank test card to meter department as reminder of test due.

FLAMENOL*

BUILDING WIRE

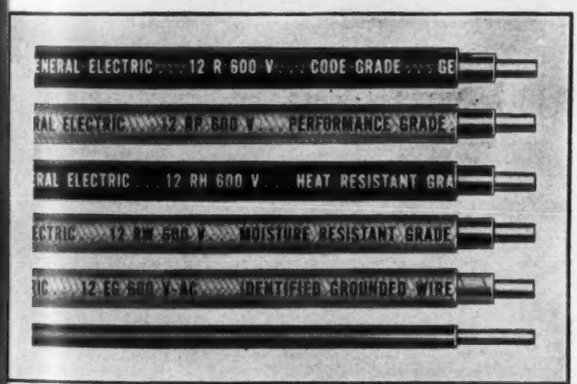
TYPE SN

For War Purpose Wiring

Flamenol Small Diameter Building Wire, insulated with a plastic compound, is again offered for maintenance work, for rewiring and new wiring and for machine connections. The available supply of resins has improved. They are being allotted for electrical conductor insulation where copper has been allocated.

Think of the advantages that Flamenol provides. Its small diameter permits more wires to be used in conduits for both rewiring and new wiring. It is easy to install and will give long service. Its insulation is superaging, high in dielectric and mechanical strength, flame retarding and resistant to moisture, oil, acid, etc. It is available in sizes 14 to 4/0 which enables it to be used for feeders as well as branch circuits.

*Reg. U.S. Pat. Off.


ENERAL ELECTRIC 12 R 600 V CODE GRADE GE
RAL ELECTRIC 12 RP 600 V PERFORMANCE GRADE
ERAL ELECTRIC 12 RH 600 V HEAT RESISTANT GRA
ECTRIC 12 RW 600 V MOISTURE RESISTANT GRADE
IC 12 EG 600 V AC IDENTIFIED GROUNDED WIRE

G-E STANDARD BUILDING WIRES

Standard G-E Building Wires with five different grades of insulation are available for war jobs: Type R, Code grade; Type RP, Performance grade; Type RH, Heat Resistant grade; Type RW, Moisture Resistant grade; Type EG, Neutral Conductor. G-E single- and multi-conductor lead-sheathed wires and cables are also available. All of these wires are high quality, carefully made of the finest raw materials.

★ ★ ★

FOR FURTHER INFORMATION *on Flamenol Small Diameter Building Wire, the five grades of G-E Standard Building Wire or G-E Lead-sheathed Wires, see the nearest G-E Merchandise Distributor or write to Section W632-9, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.*

GENERAL ELECTRIC

This advertisement appears in the June 2 issues of the New York Herald-Tribune, Chicago News, St. Louis Post Dispatch, San Francisco Chronicle, Washington Times-Herald, Philadelphia Inquirer, Los Angeles Examiner, Dallas News, Boston Herald Traveler, Cleveland Press, Detroit News, Portland Oregonian, Buffalo News, Pittsburgh Press and in the June 19 issue of Business Week.

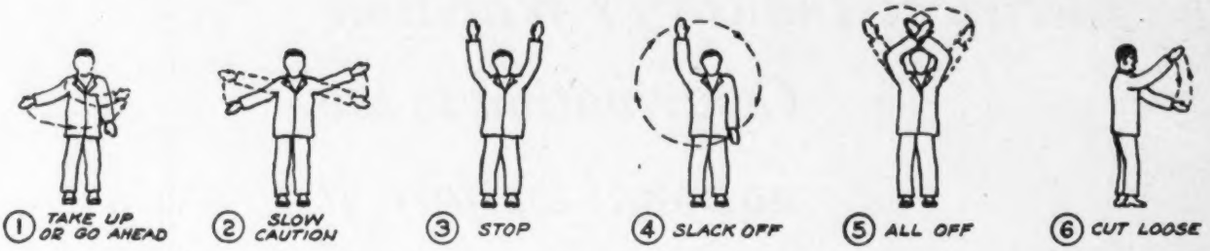
If General Cable can arouse public opinion to a fuller appreciation of the Electrical Industry's War-time Contribution to the national welfare, it will have realized its hope to have rendered a constructive service.

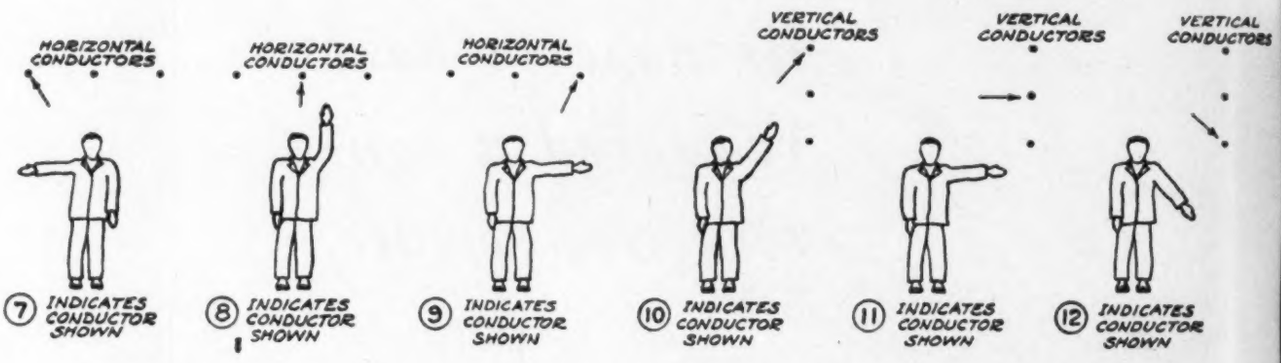
GENERAL CABLE

General Cable Corporation Sales Offices: Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Houston, Kansas City (Mo.), Los Angeles, New York, Philadelphia, Pittsburgh, Rome (N.Y.), St. Louis, San Francisco, Seattle, Washington (D.C.)

STANDARD SIGNALS FOR LINEWORK

Manual signals to indicate direction of pull, speeds and specific conductors have been adopted as one of the transmission line maintenance and operation practices of the Southern California Edison Company, Ltd., Los Angeles. The signals are illustrated here and should be helpful to present employees and in the quick training of new employees.





HOIST SIGNALS

EXPLANATORY NOTES FOR RESPECTIVE SIGNALS

1 This signal is used to indicate the direction of pull. Faster or slower motions of this signal are used to indicate speeds other than caution or slow speeds. Where there is a choice of conductors to be pulled this signal is given with one of the indicating signals Nos. 7 to 12 inclusive.

2 This signal always follows either No. 1 or No. 4 and is an indication of slow speed for caution. This signal must be given continuously while the pull is being made at slow speed and is to be terminated by either giving the No. 1, No. 4 (depending on direction) or No. 3 signal.

4 This signal is used to indicate the direction of pull and is used in slacking or lowering as No. 1 is used for taking up.

7-12 These signals are always used in connection with either No. 1 or No. 4 and are given at the same time as either No. 1 or No. 4 is given. In using No. 10, No. 11 and No. 12 the man's arm on the wire side to be pulled is used for the indicating signal.

13-15 These signals are to be used only when the signalman is within 50 ft. of the truck operator.

★ **L-M Fuse Links are absolutely accurate and uniform**
Manufactured to close tolerances on special machines of L-M design, assembled by skilled workers, each L-M link is individually tested for uniform resistance.

★ **L-M Fuse Links are mechanically strong**
Each L-M link is tested for 15 pounds minimum mechanical strength.

★ **L-M Fuse Links are unmistakably marked**
Each L-M link carries its rating in two places for quick, dependable selection, also ready identification of a blown link size.

★ **L-M Fuse Links are well protected**
L-M Fuse Links are packed in strong, practical cartons, each link separately protected, to assure a perfect link when put in service.

★ **Backed by experience**
Today's L-M Fuse Links are better because they are the result of over 20 years of fuse link research and development by Line Material Company, one of the oldest names in the industry.

Everything you need to know about fuse coordination is contained in the 24-page L-M Booklet No. 42101, definitely the most complete manual of its kind. Write for your copy to Line Material Company, 802 N. 8th Street, Milwaukee, Wisconsin.

LM

LINE MATERIAL COMPANY

Synchronizing Wound-Rotor Motors—II*

By A. F. METZGER
General Electric Company, Boston, Mass.

A method permitting synchronism of wound-rotor induction motors of different ratings or with different open-circuit secondary voltages has been tried successfully. In all probability, this scheme has not been used previously. It is inexpensive and quickly applied — particularly valuable features at present, when it takes so long to obtain new motors of a particular rating and when priorities are required.

This new method extends the range of usefulness of the synchronizing characteristic of wound-rotor motors to include motors of different ratings or with different open-circuit secondary voltages. All that is needed is an auto-transformer in the secondary circuit of one motor to make the transformed secondary voltage equal to the secondary voltage of the other motor.

Use Standard Transformer

At first glance it does not seem feasible to use a standard transformer in a circuit where the frequency varies from full line frequency at the instant of starting down to nearly zero at a maximum motor speed. This is possible, however, because the secondary voltage varies almost directly with the frequency.

It is generally known that two or more identical wound-rotor motors will lock in step with each other if their secondaries are paralleled and connected to the same resistor. This is a form of selsyn operation or synchronous tie operation.

When two similar wound-rotor motors are tied together for selsyn operation the amount of power that can be transferred between the secondaries to maintain synchronism varies with secondary voltage available and hence with slip. In general, it is necessary to keep the slip above 20 percent to insure ample torque, which means that the speed should not exceed 80 percent of normal full-load speed.

In the case of differently rated motors, the amount of power that can be transferred depends not only on the slip but also on the ampere rating of the motors. It is obvious that a very small motor when paralleled with a large one cannot have very much effect on the large motor without overheating its own secondary. Therefore, before applying this new method it is well to consider the load fluctuations that may occur to be sure of always having enough torque.

The capacity of transformer required is usually only a fraction of the capacity of the smaller motor, thus making this method very inexpensive. The auto-transformer should have the same nominal frequency as the supply line, a voltage ratio equal to the ratio of the two secondary open-circuit voltages, and a current rating equal to the secondary-current rating of the smaller motor.

A secondary resistor and drum switch should be selected which will be large enough to carry the combined secondary current for two motors with enough resistance to give the required speed range. In general, the size of the resistor will be about the same as a resistor for a single motor having a horsepower rating equal to the combined horsepower ratings of the two motors. Since the speed should not be allowed to exceed 80 percent of rated full speed, it is well to connect the drum switch to the resistor in such a way that a small amount of resistance is always in the circuit. This permanent section should be continuously rated.

It is always necessary to have the secondary phase rotation the same in both motors. In the case of two similar motors which do not require a transformer, it is merely necessary to interchange two leads, but when a transformer is used there may be twelve or more extra leads to handle and, therefore, more care in wiring is required. The necessity of having the same phase rotation does not mean that it is necessary to have the same rotor rotation. (Phase rotation is electrical.)

An application of the drive in a textile mill will be outlined in a subsequent issue.

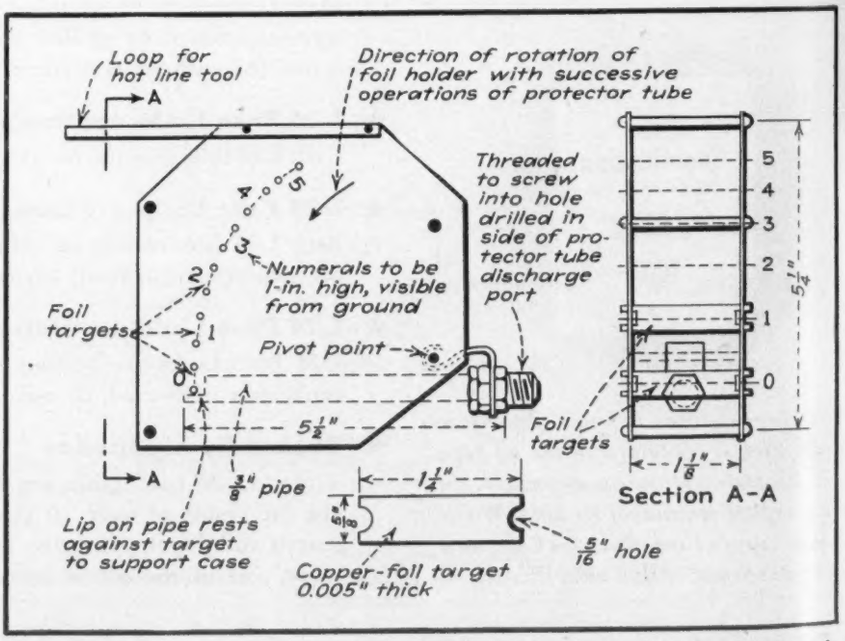
*Part I was published in "Electrical World," May 29, 1943, page 68.

•

Counts Deion Tube Operations

Number of operations and therefore the life expectancy of Deion protector tubes used on certain high-voltage transmission lines of the Union Electric Company of Missouri are determined by the "operation counter" shown in the accompanying sketches.

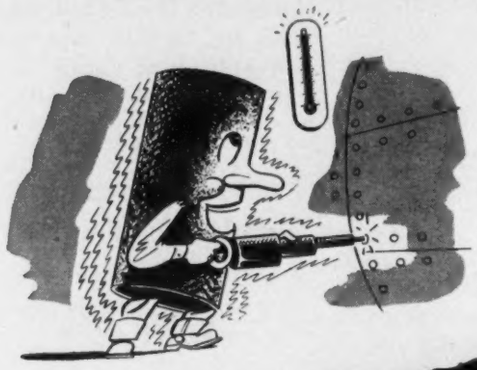
This simple device attaches directly to the side of the exhaust port of the tube and uses the blast from the tube that accompanies each operation to expel a thin copper foil diaphragm or "target." This alters the position of the indicator to give the line patrolmen a direct reading of

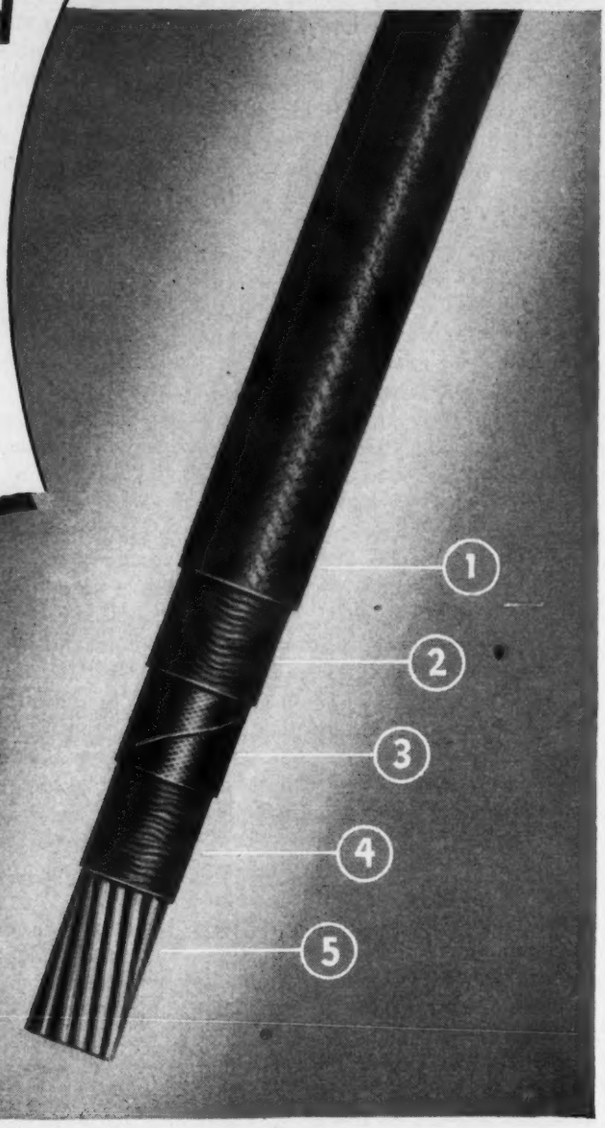


DEVICE attached to protector tube on transmission lines indicates operations experienced: is used as guide to replacement

ROCKBESTOS A.V.C.

Withstands HEAT and VIBRATION





ROCKBESTOS PERMANENT INSULATION INSURES LONG-LIVED PERFORMANCE

Rockbestos A. V. C. Power Cable above and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction.

1. A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

2. Outer felted asbestos wall which serves as a heat-barrier against high ambient temperatures.

3. Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat and flame by two felted asbestos walls.

4. Felted asbestos insulation that withstands conductor-heating overloads and won't burn even when exposed to copper-melting arcs.

5. The conductor is perfectly and permanently centered in helically applied insulation.

One of 122 different wires and cables developed for severe operating conditions.

RESISTS moisture, oil, grease and fumes.
WON'T bake brittle, burn, flow or rot.

In electrical circuits that run around hot strip mills, soaking pits, furnaces, boilers, lehrs, kilns, forging presses—wherever heat and vibration causes wire failure too often—you'll find Rockbestos A. V. C. living up to its reputation of providing trouble-free, dependable performance under the toughest conditions.

Designed especially for high temperature applications, *permanently insulated* Rockbestos A. V. C. won't crack, bake brittle, bloom, rot or swell. It resists heat, flame, moisture, grease, oil and corrosive fumes.

Avoid serious production delays caused by wire failures, use Rockbestos A. V. C. wire, cable and cord in "hot-spot" circuits.

When inquiring or ordering, please furnish CMP certification and allotment number with delivery month number. For full particulars, write nearest branch office or: Rockbestos Products Corporation, 898 Nicoll Street, New Haven, Connecticut.

ROCKBESTOS

ROCKBESTOS A.V.C. *The Wire with Permanent Insulation*

NEW YORK, BUFFALO CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

FOR VICTORY—INVEST IN U. S. WAR BONDS

the number of operations that have been experienced. The indicator can be read from the ground and up to six operations can be indicated on the device without resetting.

As shown in the accompanying drawing, the device consists of a short ⅜-in. diameter tube with a lip at one end and threaded at the other to screw into a hole drilled in the side of the discharge port on the protector tube. The sheet metal indicator housing is suspended from and pivoted about a hook attached to this tube. A series of six copper replaceable foil diaphragms, arranged in an arc, are wedged between sides of the indicator housing. The lower or first of these diaphragms rests on the lip and over the open end of the tube projecting from the exhaust port. Upon operation of the tube, the accompanying blast of gas expels the foil diaphragm and causes the indicator housing to pivot on its hook until the lip of the tube comes to rest on the next foil diaphragm. The position of the indicator housing, corresponding to large numerals on its face, indicates the number of foil diaphragms expelled and therefore the number of tube operations.

The indicator housing has been provided with a loop so that it can be removed and replaced with hot line tools when all six foil diaphragms have been ruptured.

This operation counter, developed by the Westinghouse Electric & Manufacturing Company, has been used on parts of the Union Electric Company's transmission system for a number of months. By indicating the number of operations experienced by a given tube it indicates when the useful life of the tube has been reached, and this guides replacement.

Comprehensive Record of Power Bank Loads

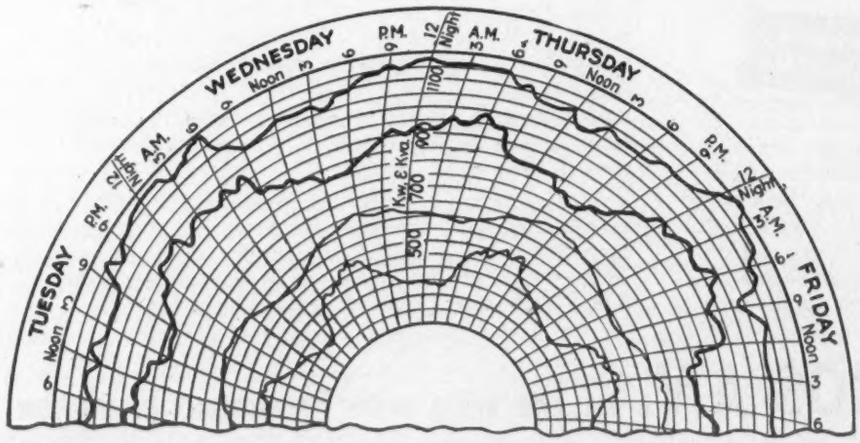
In these days, when a power transformer is considered to be shirking its duty if it is not carrying full load or better, a solicitous watch must be kept on transformer operation. And the best watch is that which comes closest to seeing all and knowing all all the time. Which means frequent checking of transformer loads and conditions and statement of check results as completely as possible in clearly shown record.

An excellent form for such a record is that used by a Southeastern utility and of which an example is shown in the accompanying illustration.

On one transformer of a bank which is indicated by routine report to be operating nearly up to or above rated capacity a seven-day circle chart record of ambient and top oil temperature is made. At the same time graphic records of voltage, amperage and wattage for the bank are obtained.

On the circle chart that shows top oil temperature, indicating the hottest transformer in the bank, time-coincident curves of bank kw. and kva. taken from the three other charts are drawn by hand. In some cases the copper hot spot temperature may be calculated and entered on the chart. The circle chart is then pasted on a sheet for insertion with others of its kind in a loose-leaf binder, which is thus a convenient, comprehensive working record of operating conditions of all fully or over-loaded transformer banks on the system.

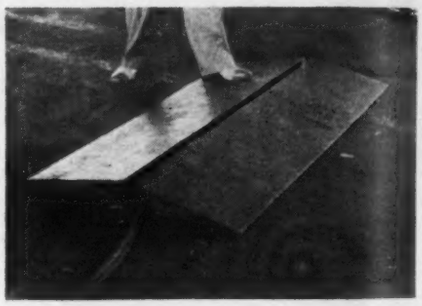
To make them readily distinguishable different colored inks are used for each of the four curves assembled on a chart; for instance, green ink for ambient temperature, red for top oil, blue for kw. and brown for kva. Frequent consultation of the contents of the binder enables the responsible engineer to know what banks need attention and what recourse may be advisable in a particular case—possibly fans for air-blast cooling will carry a bank through a period of hot weather or maybe it is advisable to hook up a portable capacitor bank to improve power factor until transformer size can be increased.



BANK LOAD in kw. and kva. drawn on chart of hottest transformer temperature: first inside curve is ambient temperature, next is top oil, next is kw. and outside is kva.

Protect Portable Cables on Floor

Widespread use of electric welders and other heavy-duty portable electric equipment in shipyards has necessitated the provision of some form of protection for cables laid across those areas where heavily loaded industrial trucks equipped with steel tires frequently pass. A novel safeguard, which in itself is portable, has been designed by Calship for use in its San Pedro shops. As shown in the illustration, this consists of sections of steel plate welded into a cross-over guard by means of some small wedge-shaped supports. From either direction truck wheels will go up a slight rise and pass over the cables. The slot in the top of the guard is wide enough so that the cables to be protected will pass through it into the space below. The transverse width of the guard is only slightly more than the width of the trucks.



WELDED GUARD protects cables against damage from steel truck wheels in shop of California shipyard

In addition to electric cables, the guard will protect compressed air hose or other portable facilities which might be damaged by truck wheels.

New! A MOTOR DRIVEN POWERSTAT

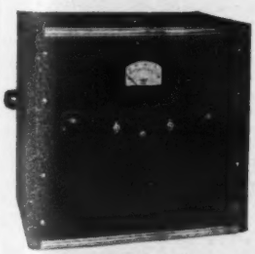
Now you can control large amounts of power with a simple push button

NO longer is it necessary to sacrifice range and smoothness of control by using antiquated, inflexible tap changing devices and heavy wiring to control A.C. voltage and power. **SECO** has solved the problem of obtaining a continuous, distortionless and simple control of large amounts of power. A standard line of **MOTOR DRIVEN POWERSTATS** in sizes up to 75 KVA for single or polyphase operation on 115, 230 or 440 volt circuits is available. You can select a standard unit for your application or where necessary special designs can be manufactured to meet your requirements.

Engineered combinations of **POWERSTAT VARIABLE VOLTAGE TRANSFORMERS** and a **HIGHLY DAMPED SYNCHRONOUS DRIVING MOTOR** of low fundamental speed are the answer to efficient, quick, convenient and continuous control of power.

STANDARD AIR COOLED POWERSTAT

For more than five years SUPERIOR ELECTRIC COMPANY has specialized in CONTINUOUSLY VARIABLE VOLTAGE TRANSFORMERS and has won the confidence of THE ARMED FORCES AND INDUSTRY. Investigate POWERSTAT VARIABLE TRANSFORMERS for your control problem. Standard types are manufactured for single or polyphase operation on 115, 230 or 440 volts.



SECO AUTOMATIC VOLTAGE REGULATOR

Incorporating a Synchronous Motor Drive, SECO DISTORTIONLESS AUTOMATIC VOLTAGE REGULATORS deliver constant output voltage with variations of applied voltage and frequency. The output is unaffected by changes in power factor or magnitude of load. Available in sizes up to 75 KVA.

SEND FOR BULLETINS 149 WE (POWERSTAT) AND 163 WE (REGULATOR)

SUPERIOR ELECTRIC COMPANY

40 LAUREL STREET **BRISTOL, CONNECTICUT**

A GUIDE FOR WIRE CLEARANCES*

Indicated clearance values (feet) for wire crossings and for wires from the ground or rails are in accordance with the National Electrical Safety Code, 1941 Edition, and on the basis of 60 deg. F. and no wind

Minimum Clearances of Wires at Point of Crossing

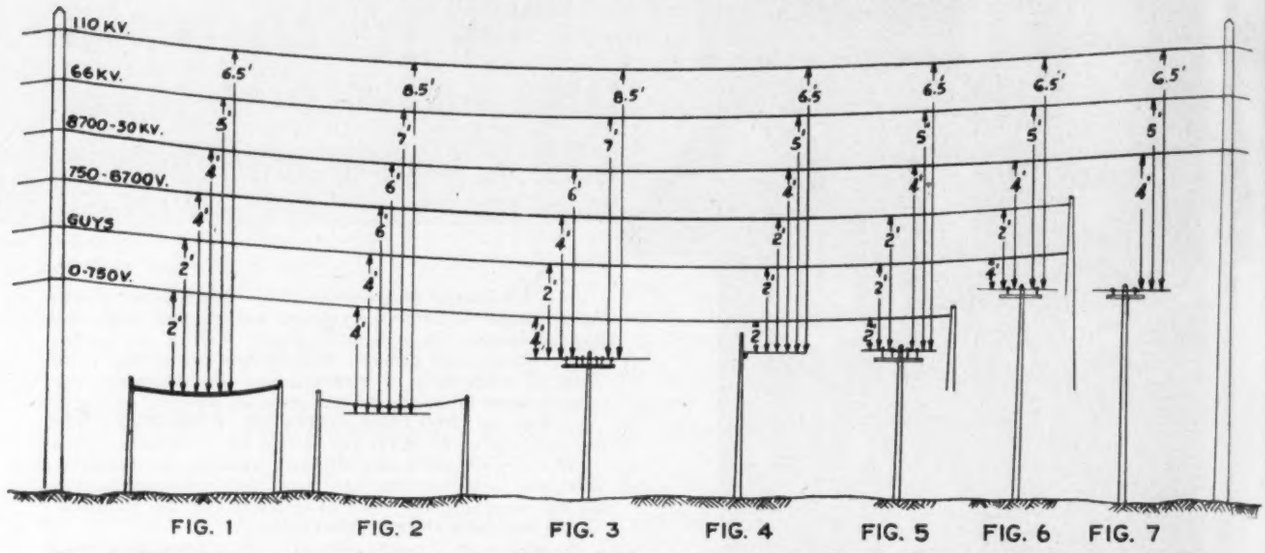


Fig. 1—Span wires, guys and messengers. Fig. 2—Trolley contact wires. Fig. 3—Communication wires and cables. Fig. 4—Supply cables, all voltages. Fig. 5—0-750 volts. Fig. 6—750-8,700 volts. Fig. 7—8,700 volts—50 kw.

Minimum Clearances of Supply Wires from Ground or Rail

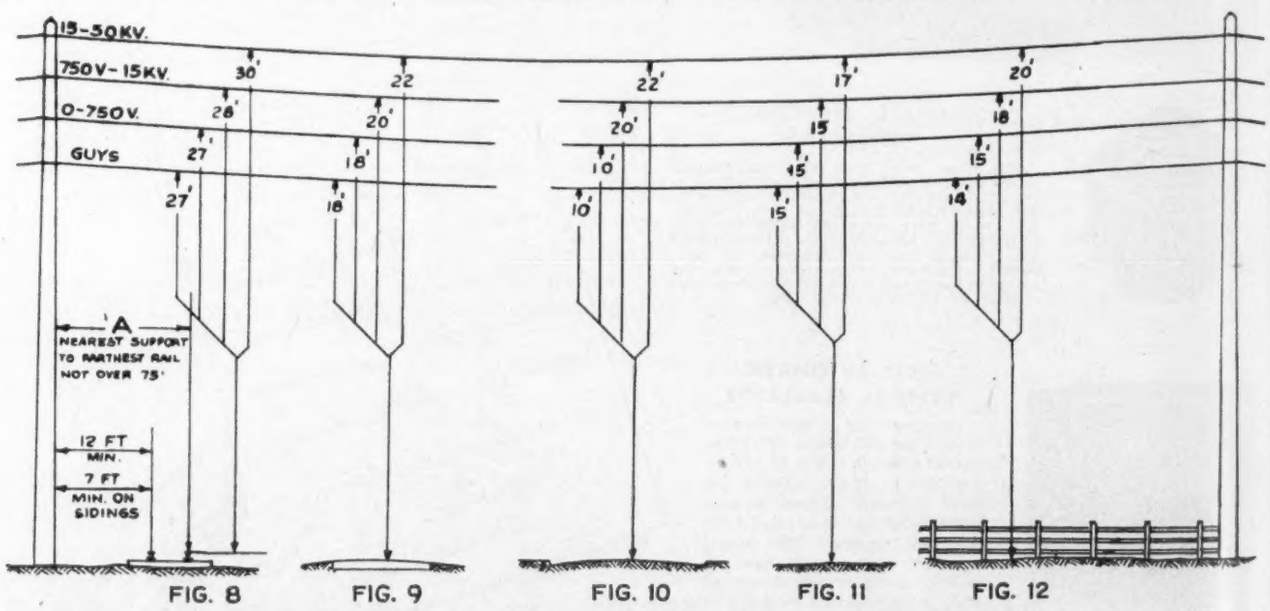


Fig. 8—Crossing railroad. Fig. 9—Crossing public streets, alleys or urban or rural roads, running along urban streets or alleys. Fig. 10—Crossing driveways to residence garages. Fig. 11—Crossing spaces accessible to pedestrians only. Fig. 12—Running along rural roads.

NOTES

Note for Figs. 1-8—Add 0.15 ft. for each 10 ft. of span over 175 ft.

Note for Fig. 8—Add 0.30 ft. for No. 6 copper.

Note for Figs. 9-12—Add 0.10 ft. for each 10 ft. of span over 175 ft.

Note for Figs. 1-12—Increase need not exceed 75 percent of the difference between final unloaded sag at 60 deg. F., no wind, and maximum loaded sag.

* Adapted from Overhead Construction Standards of New England Power System

Who else needs help at 35,000 feet?

AT FIRST GLANCE, you might think that *no one else* needs help to fly at high altitudes—once you've supplied the airplane's crew with oxygen masks and heated flying suits.

But, as Army and Navy Air Forces engineers found out a few years ago, *such is not the case.*

At high altitudes, as electrical engineers know, the electrical wire and cable in a plane need help too. It's now common knowledge that the distribution of electrical energy becomes more difficult to control as the air gets rarer.

Today, the Army and Navy have an electrical insulation which resists the effects of corona at high altitudes. They got it by putting the problem up to the electrical industry. In solving this problem, electrical design engineers skillfully put Fiberglas to its best use by combining it with the newest improved impregnants.

Yet, these Fiberglas combinations have not only the virtues of . . . *high dielectric strength and high corona resistance.*

They are also *moisture-resistant . . . highly resistant to heat . . . unaffected by most acids.*

For all these good reasons, the aviation industry's demands for Fiberglas have been constantly growing with the fast-expanding output of planes.

The demands for Fiberglas-insulated motors and generators in planes have also greatly increased. In addition, the growing use of electrical equipment for Navy ships and many types of Army mechanized fighting and transport units has resulted in further demands for Fiberglas insulation.

To meet these demands, the production of Fiberglas was greatly increased last year . . . output is still being expanded every month, and will continue to be.

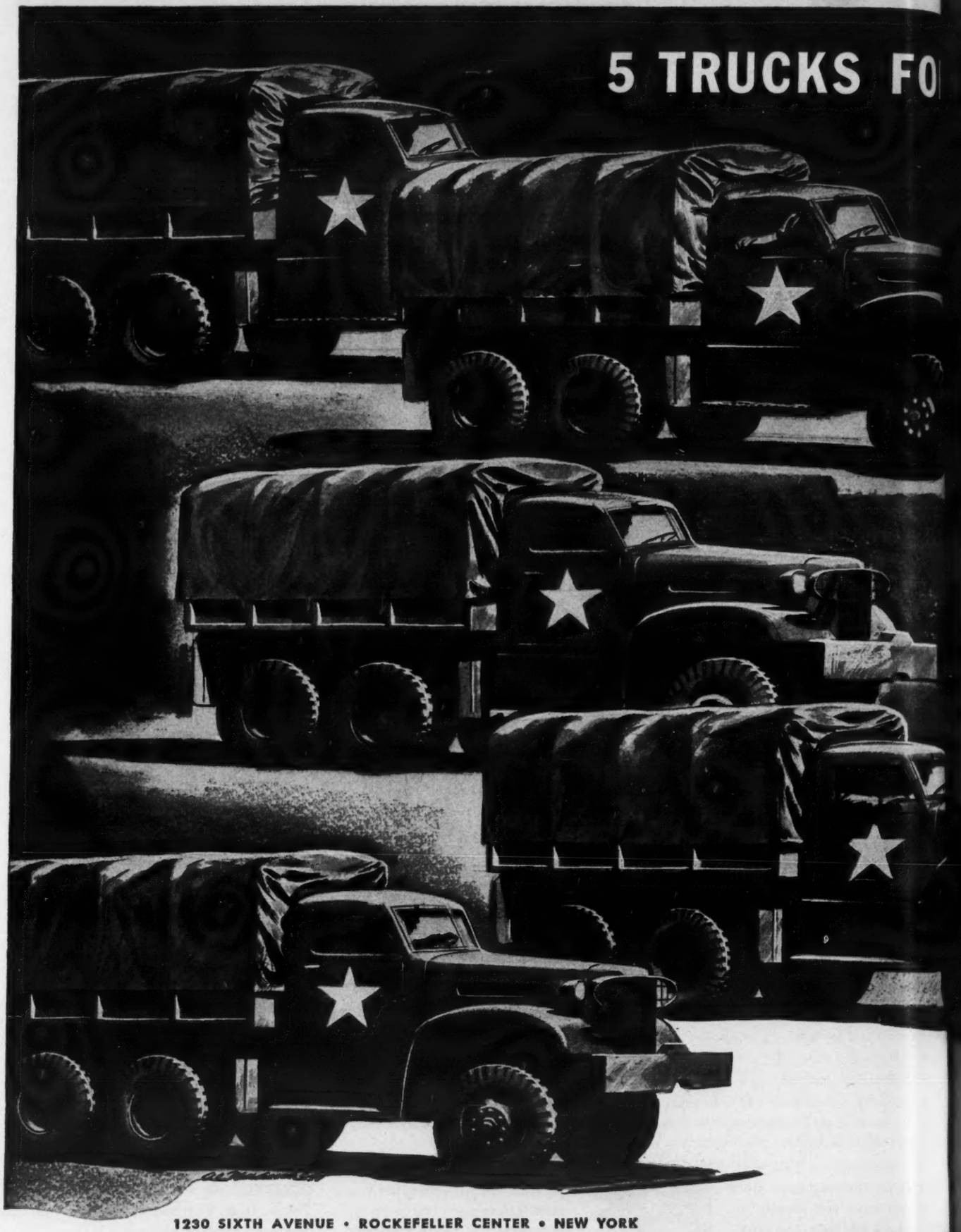
For both the electrical industry and Fiberglas are determined to do everything possible to make Fiberglas available for every vital wartime use.

• • •

Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.

FIBERGLAS* ELECTRICAL INSULATIONS

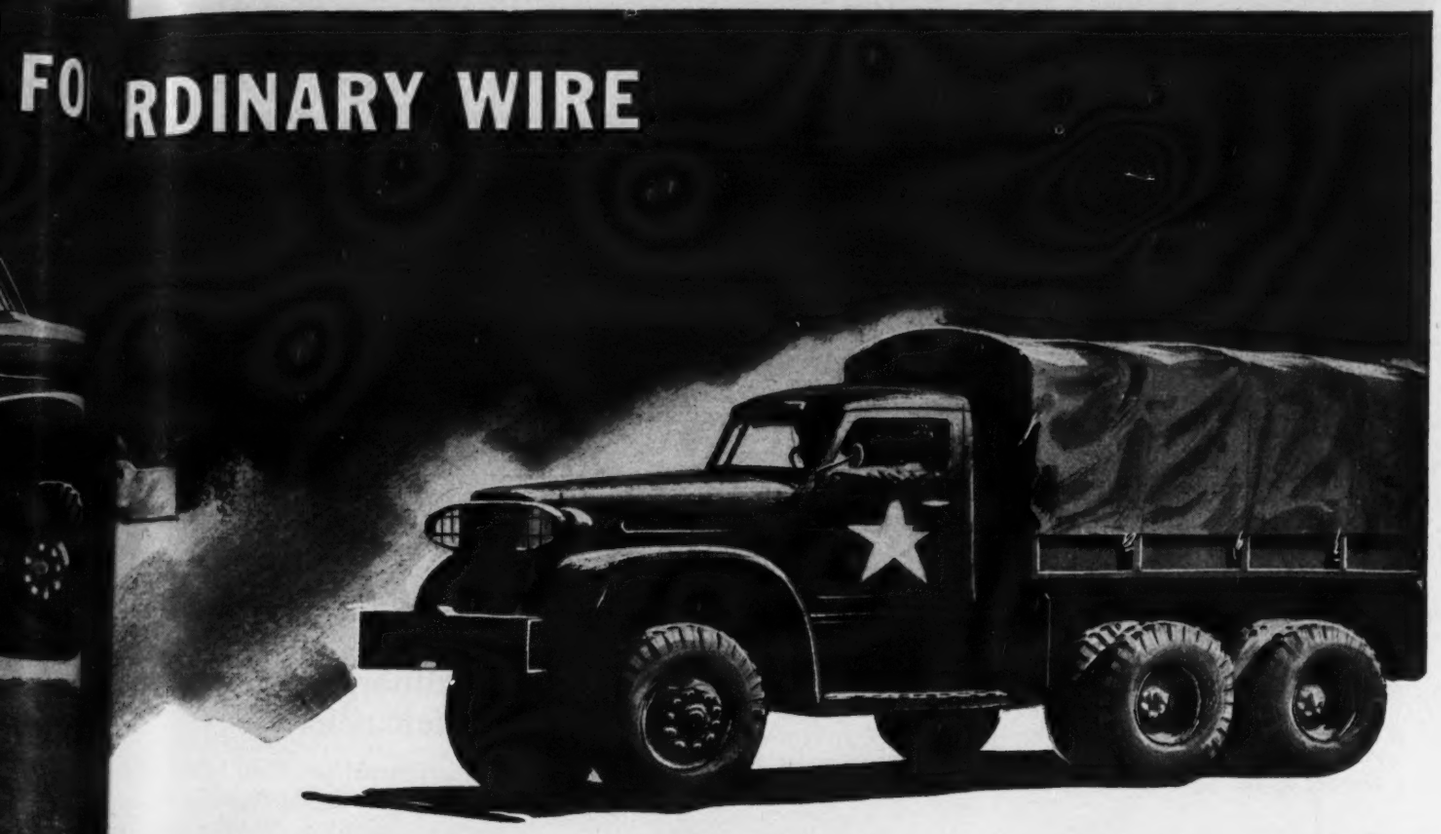
*T. M. Reg. U. S. Pat. Off.



1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK

UNITED STATES

FO RDINARY WIRE



TRUCK FOR U.S. *Laytex* ASSAULT WIRE

REG. U. S. PAT. OFF.

4 TRUCKS RELEASED FOR OTHER MATERIEL TRANSPORT

Every day our Armed Forces are in the field, distances from base to front lengthen... problems of transportation increase... every cubic foot of space that can be saved for the S.O.S. is vital.

U. S. Laytex Assault Wire requires only 1/5 *the space in transport of ordinary communications wire.*

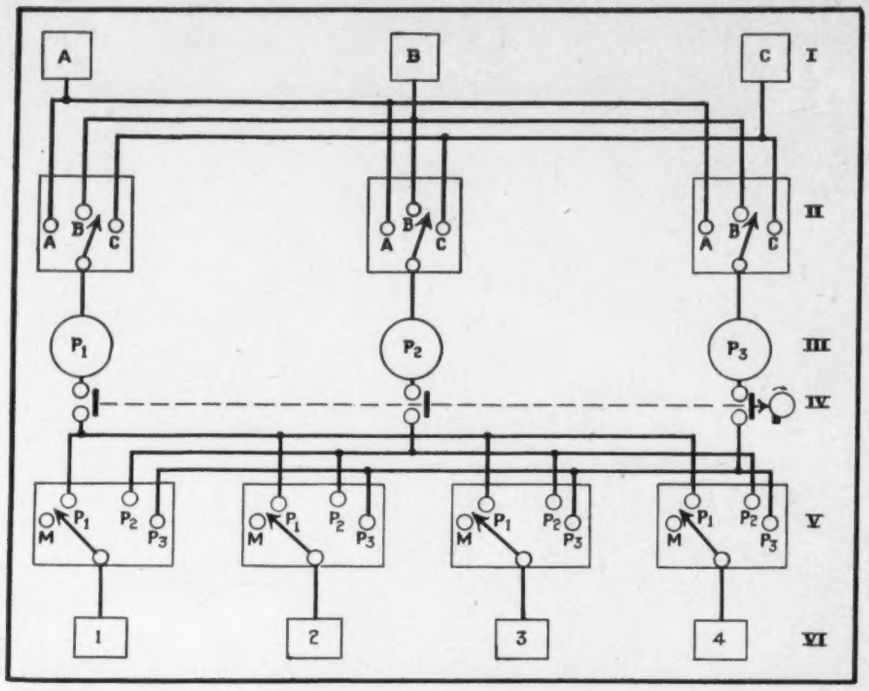
In the unique Laytex Process, the compounded, purified latex is applied to the electrical conductor by dipping. Conductors are perfectly centered and the weight of the insulation and the diameter of the insulated conductor are kept at the minimum.

Lightweight and small bulk are only two advantages of U. S. Laytex Assault Wire. It resists concussion and a wide range of temperature changes. Laytex is waterproof and extremely flexible.

Laytex Assault Wire weighs less than 30 lbs. per mile...a mighty important feature when men are marching with full equipment. It has a talking distance of five miles and a breaking strength of 50 lbs. per conductor.

UNITED STATES RUBBER COMPANY · US · TRADE MARK

RUBBER COMPANY



SINGLE-LINE DIAGRAM of automatic current regulating system. Roman numerals are references to equipment listed in text. Scheme provides for departure from proportionality of d.c. output voltage to input a.c. voltage

Regulating System for Converter Loads*

A regulating system has been developed to hold constant the combined output of several synchronous converters supplying direct current to electrolytic cells. The system contributes to improvement in over-all plant performance by reductions in labor and reductions in power cost through improved load factor, according to L. H. Fletemeyer, electrochemicals department of E. I. du Pont de Nemours & Company, Inc., Niagara Falls, N. Y.

Accompanying diagram illustrates the regulating system used for three loads and selected converters. Essential parts for the system are:

I. Three shunts, A, B, and C, for measuring the individual load currents to be regulated.

II. Three multi-position instrument switches, designated "load selector switches," which are mounted next to the potentiometers. They enable the operator to select the load to be measured by each potentiometer.

III. Three contact-making ampere meters, P_1, P_2 and P_3, for current measurement and control. They have adjustable "high" and "low" contacts to operate motor-driven field rheostats which increase or decrease the converter output so as to restore the load to preset value.

IV. One "motor-driven timing relay" which is a synchronous motor-driven timing switch or interrupter. Its sole purpose is to prevent the regulating system from excessive hunting due to over-travel when making corrections. One interrupter is used for the three potentiometer controllers.

V. Four multi-position instrument switches, designated "control selector switches." One is required for each converter to be controlled. Their purpose is to enable the operator to select the proper potentiometer controller for each machine consistent with (1) the load the machine is connected to and (2) the potentiometer being used for current measurement. Position "M" on the switch is for manual control, if necessary, of the field rheostat.

VI. Four motor-driven main field rheostats on selected converters, which are used to accomplish the desired load regulation. The motors are connected to a circuit from the 125-volt station control battery.

Charts have been made for manually controlled loads and automatically regulated loads. They show that the latter is held practically constant within plus or minus 0.5 percent of the desired amount, whereas the manually regulated loads generally run above or below the desired amount as much as 1.5 to 2 percent for appreciable intervals of time. Other charts were made showing the total d.c. ampere load, total plant kilowatt load and incoming line voltage.

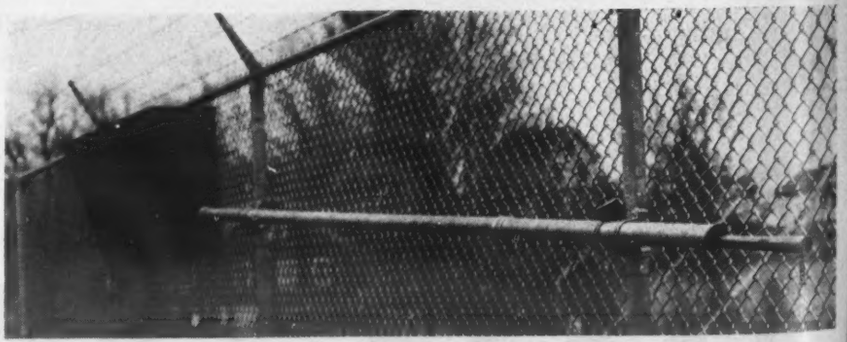
From an electrical standpoint the principal conclusions made are: (1) Plant load factor can be increased toward unity, thereby contributing to lower purchased power costs and minimum firm power contracts, and (2) voltage of the power transmission system is steadier, since, with converter output held constant by automatic regulation, the cumulative effects on transmission line voltage drop caused by load swings in the plant itself are minimized.

*Excerpt from a paper presented at a recent meeting of the Electrochemical Society at Pittsburgh, Pa.

•

Weatherproofing Switchsticks

Impregnated wooden switchsticks used by the New Hampshire Gas & Electric Company, Portsmouth, at non-attended substations are protected from adverse climatic conditions by housing them in 2-in. inclined pipe conduit as shown, attaching the container by four conduit clamps to two 2-in. vertical pipe posts inside the fencing guarding the transformer yard. The conduit is inclined at an angle of about 10 deg. for drainage purposes, and a $1\frac{1}{2}$ x $\frac{3}{4}$-in. slot at the lower end enables any accumulated water to run off while providing room for the operating pin at the end of the switchstick. The container is about 13 ft. long and is fitted with a brass cap at the lower end. Originally an iron cap was provided, but this required unscrewing by a wrench and was replaced by brass to facilitate turning it by hand. At the rear, left, is shown a simple but effective



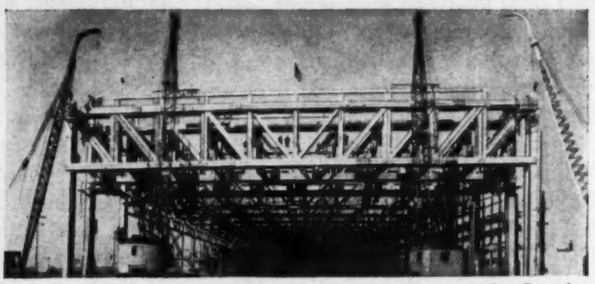
WOODEN SWITCHSTICK housed in inclined conduit for protection from adverse climatic conditions

FREEDOM IS NOT FREE—IT IS PRICELESS ★ *BUY WAR BONDS*

GUARDIANS OF VITAL WAR MATERIAL

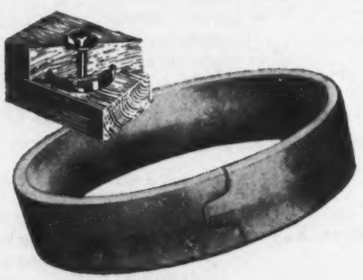
WOOD GOES TO WAR
An MGM Technicolor short by James A. Fitzpatrick.
Ask your theater when you can see it.

Timber Builds Great Plants for War and Peace



A section of the giant, all-timber assembly plant of the Douglas Aircraft Company, just opened for operations. Architect-Engineer-Manager, The Austin Company, Chicago.

Engineers, Architects, Designers, Builders in every field of industry now are using engineered timber for heavy duty structures. The TECO Timber Connector System made this possible. You, too, can design in timber with TECO. Write for our literature today.



The ***TECO*** *Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.*

TIMBER ENGINEERING COMPANY
NATIONAL MANUFACTURERS OF TECO TIMBER CONNECTORS AND TOOLS
WASHINGTON, D. C. **PORTLAND, OREGON**

triangular wooden shelter for a folding stepladder maintained on the premises.

•

Series Capacitors—Where Place? How Big?

Rating Calculation*—V

By S. LUBIN
Engineer, REA Technical Standards Division

Series capacitors are rated by specifying the capacitive reactance in ohms, the line-to-ground voltage and terminal-to-terminal voltage ratings.

The capacitive reactance required will depend on the power factor and size of the load. For a given load, the lower the power factor (lagging), the smaller the capacitive reactance required to provide a given correction. Therefore, the capacitor rating should be based on the greatest load and the lowest (lagging) power factor, which conditions will usually occur at the same time. If these two divisions do not occur at the same time a check should be made at various points to see which combination provides the greatest rise. If the ratings are based on a light load and high power factor the voltage rise which would accompany an increase in load or a lowering of the power factor might be excessive.

In the system shown in the illustration in the third installment assume the power factor to be 75 percent at full load and 90 percent at light load. The full load power factor will, therefore, determine the selection of capacitor rating.

The capacitor reactance in ohms can be found by the formula:

$$X_C = \frac{10\,E^2\,V}{K_L \sin\theta} \qquad (1)$$

where X_C = capacitive reactance in ohms (per phase)
K_L = kva. at full load beyond the proposed capacitor location (per phase)
θ = power factor angle at full load
V = percent voltage rise desired at capacitor location
E = phase-to-neutral system kilovolts

The percent rise at light load (V_N) can then be found from:

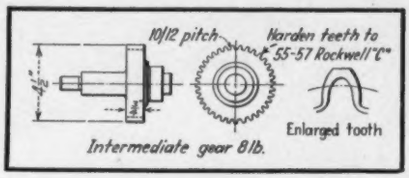
$$V_N = \frac{K_{LN}\,X_C \sin\theta_N}{10\,E^2} \qquad (2)$$

where K_{LN} = load kva-per phase beyond proposed capacitor installation *at light load*
θ_N = power factor angle *at light load*

*This series began in the April 17, 1943, issue of "Electrical World."

Induction Heating vs. Carburizing

Saving of 43 percent in cost of case hardening gears by use of induction heating as against carburizing was cited by Frank W. Curtis, chief engineer Van Norman Machine Tool Company, in a paper to the recent "Machine Tool Forum" sponsored by Westinghouse at East Pittsburgh.



COMPARATIVE COSTS for hardening a gear by carburizing and induction heating

Cost and Operation	SAE-1020 Carburize	SAE-1045 Induction
Cost of Steel	0.40	0.43
Carburize @ $0.39/lb.	0.319	....
Cost of Heat to Harden	0.041	0.01
Cleaning	0.02	....
Total Cost	0.78	0.44
Saving	....	43%

The comparison applies to a gear of which only the teeth are required to be hardened. Quoting Mr. Curtis:

"The analysis includes the cost of steel in both cases because this difference has a relation between carburizing and induction hardening costs. There is only a fraction of a cent per pound difference in cost between the higher and lower-carbon steels, but the carburizing cost runs about 0.04 cent per pound. The cost of heating differs, too, since only a portion of the part is heated when induction hardening is applied, and the operating cost of the unit is comparatively low.

"A gear of the size shown can be hardened by induction heating in about 30 seconds floor-to-floor time, which includes fifteen seconds for heating, eight seconds for quenching and the balance for loading."

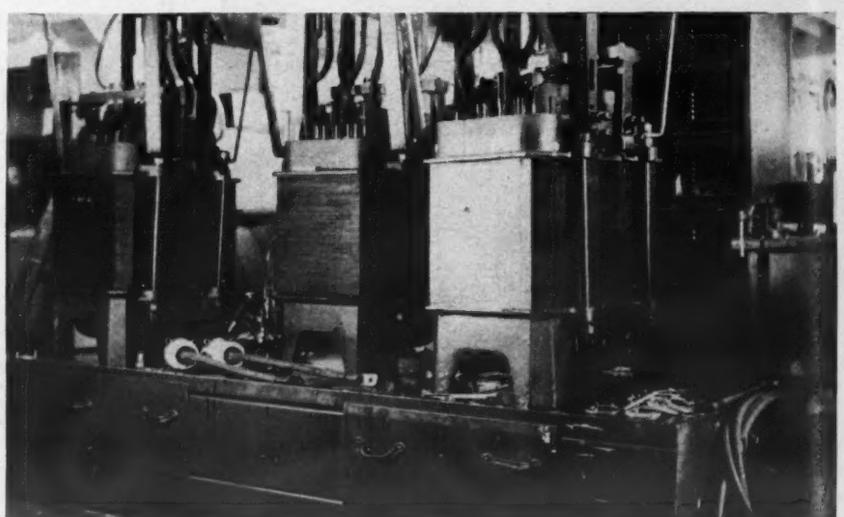
•

Low Bench Facilitates Coil Overhaul

This low workbench for transformer coil overhaul is one of four built at the Idaho Power Company shops in Boise. They have saved their cost many times over, according to Leslie Hall, transformer department foreman. First, they bring the work up to a level that is convenient for the electrician, enabling him to work with the minimum of stooping and reaching. They are also constructed so that the main body is 5 in. above the floor, saving continual stubbing of toes and off-balance reaching.

Large deep drawers are provided for heavy tools. It is also wired for 110-volt service outlet for convenient plugging in of electric tools, as well as having an air-pipe underneath with service connection. There is a shoulder ½ in. high all around the top, while four depressions or shallow gutters lead to a drain in the middle. This carries off oil drippings to a sump, from which the oil is reclaimed from time to time.

The bench is 14 ft. long, 3 ft. wide and 21 in. high. It is made of 10-gauge steel, reinforced underneath with 6-in. I-beams.



WORKBENCH has drain top, electrical and air service outlets, drawers and kick plate: men work at normal posture

250-TON
HOT METAL MIXER

EQUIPPED

FOR SAFETY WITH

1. Dual electric motor drive for *normal* operation—either motor capable of operating mixer should one motor fail.

2. Air-motor for emergency, automatic return of mixer to safe position if power fails while pouring.

but only TOTALLY SAFE *when* PROTECTED *by the* EC&M *System of* MIXER CONTROL

HOT METAL MIXERS require the utmost protection against spillage. They are normally operated by two motors, connected through the gearing to tilt the mixer for pouring and to return it to the safe position. Motors are usually of a size sufficient to permit operation by one motor should the other motor fail. In addition, an air-motor is provided for automatically returning the mixer to the upright position should power fail while pouring.

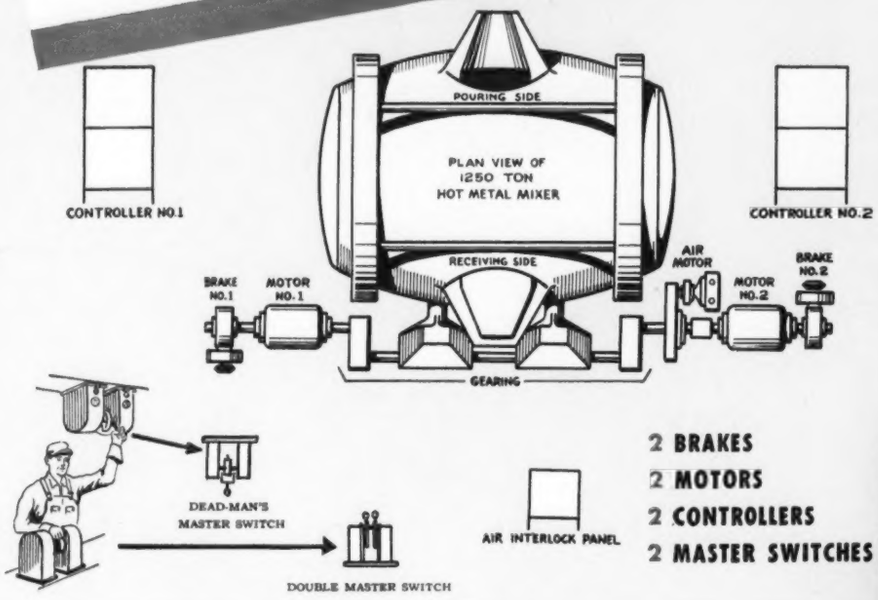
For complete safety with this arrangement, EC&M recommends and supplies 2 controllers, 2 brakes (both air and magnetically-released), 2 master switches with quickly detachable coupling and air-interlock panel. There is nothing safer than this EC&M method of control for the tilt motion of Hot Metal Mixers.

For complete details, see other side of this page

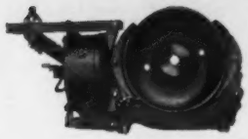
THE ELECTRIC CONTROLLER & MFG. CO. CLEVELAND, OHIO

THE ELECTRIC CONTROLLER & MFG. CO., Cleveland, Ohio

This DUAL Electric DRIVE made 100% SAFE by EC&M CONTROL SYSTEM



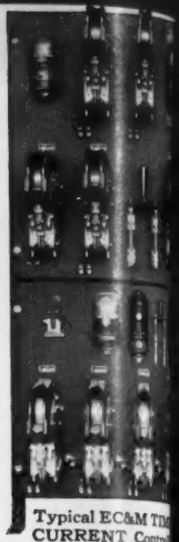
2 BRAKES
2 MOTORS
2 CONTROLLERS
2 MASTER SWITCHES



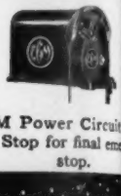
EC&M Type WB Brake with 2 separate windings, one for each motor. Also arranged for air release.

EC&M Type NT Double Master Switch, mechanically connected by quickly-detachable coupling.

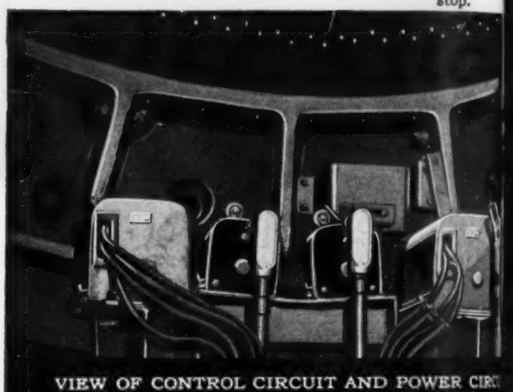
EC&M Gravity-return Dead-man's Master Switch.



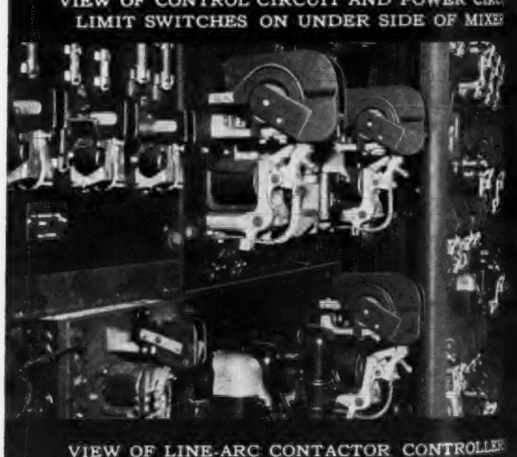
Typical EC&M TI CURRENT Contr for Hot Metal Mixer Of the Reversing-Pl Type, with Armature Slow-down on first p



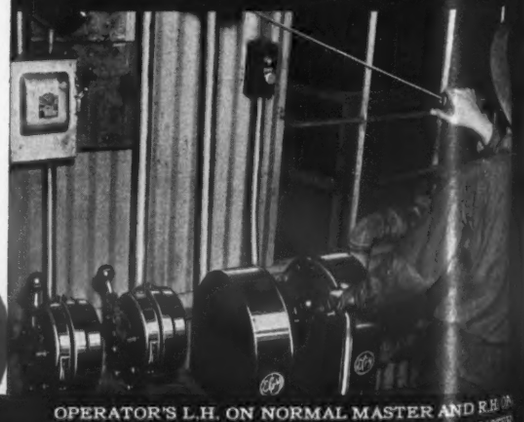
EC&M Power Circuit Limit Stop for final en stop.



VIEW OF CONTROL CIRCUIT AND POWER CIR LIMIT SWITCHES ON UNDER SIDE OF MIXE



VIEW OF LINE-ARC CONTACTOR CONTROLLE



OPERATOR'S L.H. ON NORMAL MASTER AND R.H. ON SLIDING HANDGRIP ROPE ON DEAD-MAN'S MASTE

THIS 2-motor drive with series-wound brakes is completely protected by the EC&M Method of Control. Each Brake is equipped with 2 separate windings for positive release of both brakes in an emergency should one motor or any part of one motor circuit become disabled.

No matter where the fault may occur—in the brake, the motor, the controller, or the wiring of either circuit—the other circuit maintains operation until the safe position of the mixer is reached and this is accomplished without any delay—no attention required by the operator—no time lost to operate knife, disconnect or transfer switches.

To insure that the mixer can be automatically returned by the air-motor if power fails, an EC&M Air-interlock panel is provided. This prevents tilting of the mixer by electric-motor drive unless sufficient air pressure is available to insure return by air, if necessary.

Besides eliminating the hazard of metal spillage, this EC&M Motor Control System for Hot Metal Mixer and Bessemer Converter Tilt Motions simplifies the controllers, the wiring between the motors and the control, and makes the installation not only lower in cost but easier to maintain. We invite you to discuss your requirements for these applications with us.

THE ELECTRIC CONTROLLER & MFG. CO.
2700 E. 79th Street Cleveland, Ohio

EC&M CONTROL

HANDY POLE DATA SHEET

By E. R. BONDS, Robert & Company, Inc., Atlanta, Ga.

Pole specifications of the American Standards Association, entirely adequate for their purposes, require some elaboration when they are used as base data in the design and erection of pole structures.

For instance, A.S.A. specifies circumferences; diameters have to be figured. The designer must know how deep a pole of given length should be set into the ground. The writer of bills of material must know how long the through-bolts should be for framing a pole of given class and length.

Assembly of such information on a single sheet has proved to be of much convenience in the office of Robert & Company, Inc., Atlanta.

The data sheet here reproduced shows, for all classes of Southern pine poles, distances from ground line to butt end; that is, setting depth, and circumferences and diameters at ground line and at top.

For classes 8, 9 and 10 no butt requirements are specified by A.S.A. and therefore no ground line data appear; these classes are omitted from the accompanying list.

CLASS →		1	2	3	4	5	6	7
Min. top circm / Min top diam		27" / 8.6"	25" / 8.0"	23" / 7.3"	21" / 6.7"	19" / 6.1"	17" / 5.4"	15" / 4.8"
Length of Pole	Dist. grd. line to butt	—MINIMUM— CIRCUMFERENCE & DIAMETER AT GROUND LINE						
16′	3′			Inches circum. →		21.5	19.5	18.0
				Inches diam. →		6.8	6.2	5.7
18	3½			26.5 / 8.4	24.5 / 7.8	22.5 / 7.2	21.0 / 6.7	19.0 / 6.1
20	4	31.5 / 10.0	29.5 / 9.4	27.5 / 8.7	25.5 / 8.1	23.5 / 7.5	22.0 / 7.0	20.0 / 6.4
22	4	33.0 / 10.5	31.0 / 9.8	29.0 / 9.2	26.5 / 8.4	24.5 / 7.8	23.0 / 7.3	21.0 / 6.7
25	5	34.5 / 10.9	32.5 / 10.3	30.0 / 9.5	28.0 / 8.9	26.0 / 8.3	24.0 / 7.6	22.0 / 7.0
30	5½	37.5 / 11.9	35.0 / 11.1	32.5 / 10.3	30.0 / 9.5	28.0 / 8.9	26.0 / 8.3	24.0 / 7.6
35	6	40.0 / 12.7	37.5 / 11.9	35.0 / 11.1	32.0 / 10.2	30.0 / 9.5	27.5 / 8.7	25.5 / 8.1
40	6	42.0 / 13.4	39.5 / 12.6	37.0 / 11.7	34.0 / 10.8	31.5 / 10.0	29.0 / 9.2	27.0 / 8.6
45	6½	44.0 / 14.0	41.5 / 13.2	38.5 / 12.2	36.0 / 11.4	33.0 / 10.5	30.5 / 9.7	28.5 / 9.0
50	7	46.0 / 14.6	43.0 / 13.7	40.0 / 12.7	37.5 / 11.9	34.5 / 10.9	32.0 / 10.2	29.5 / 9.4
55	7½	47.5 / 15.1	44.5 / 14.1	41.5 / 13.2	39.0 / 12.4	36.0 / 11.4	33.5 / 10.6	
60	8	49.5 / 15.8	46.0 / 14.6	43.0 / 13.7	40.0 / 12.7	37.0 / 11.7	34.5 / 10.9	
65	8½	51.0 / 16.25	47.5 / 15.1	44.5 / 14.1	41.5 / 13.2	38.5 / 12.2		
70	9	52.5 / 16.7	49.0 / 15.6	46.0 / 14.6	42.5 / 13.5	39.5 / 12.6		
75	9½	54.0 / 17.2	50.5 / 16.1	47.0 / 15.0	44.0 / 14.0			
80	10	55.0 / 17.5	51.5 / 16.4	48.5 / 15.4	45.0 / 14.3			
85	10½	56.5 / 18.0	53.0 / 16.9	49.5 / 15.8				
90	11	57.5 / 18.25	54.0 / 17.2	50.5 / 16.1				

Truck Body of Arc-Welded Design

An all-welded repair truck body designed to meet the requirements specified by the Norwalk Electric Department of Norwalk, Ohio, was constructed at less than one-half the estimated cost of a new standard body of similar design. The truck body was built by Frederick Machine Works of the same city and required only about 50 hours of welding time to complete the job. A new truck body of the type required was not available under current war conditions. Some of the welded features are given in the following:

Upper framework of the body was fabricated of $\frac{1}{16}$-in. angle iron; lower portion of $\frac{1}{8}$-in. angle iron. Fillet welds and edge welds were used throughout, using $\frac{5}{32}$-in. Lincoln Electric "Fleetweld" electrodes and a 150-amp. capacity arc welder.

Compartments and drawers were fabricated in panels extending the entire length of the body on both sides. Intermittent beads measuring 1½ in. were spaced 2 in. apart to join the $\frac{1}{16}$-in. mild steel plate used in the compartment construction. Each panel of compartments is equipped with a hinged door which fits snugly by means of special springs to form watertight protection.

Rear frame member of the body consists of a section of heavy channel iron which serves as an anchor for the boom and supporting poles used with the power winch. Three brackets are lap welded to the channel section for fastening the boom supports.

Rear step was made by arc welding a 1½x2-ft. steel plate to two angle-iron braces, which, in turn, were welded to the chassis frame. A bolt hole in the center of the step provides a means for fastening a trailer to the truck when extra carrying capacity is needed.

A unique built-in feature of the truck body is an insulated 5-gal. tank for drinking water. The tank was constructed of thin-gage welded steel plate, tack welded at the front, right side of the body near the cab.

Pulley arrangement for the boom was fabricated entirely by arc welding. The pulley bearing was welded between two $\frac{1}{8}$-in. side plates with a slot cut in one side to provide bearing lubrication. The plates were lap welded to the boom pole at the base and supported at the front by three tie bolts, arc welded to the plates at both the inside and outside joining points.

Lincoln Electric Co.

GENERAL VIEW of all-welded body for lineman's repair truck

• • •

Expedients to Dodge Shortages

Various alternatives covering a wide range of departments were reported by L. J. Gill of Pennsylvania Power & Light Company at a recent session of the electrical equipment committee of the Pennsylvania Electric Association devoted to expediencies devised to overcome war shortages. Among the self-explanatory ones were the following:

1. Use of a large number of dry cells for breaker tripping service to replace temporarily storage batteries damaged by floods.

2. Carbons from worn-out dry cells for resistance brazing. These carbons are screwed in pipe caps so as to retain them in the tongs.

3. Use of paraffin on top of battery electrolyte of open type storage batteries in anticipation of floods.

4. Rubber bands to replace springs on auxiliary switches which have lost their tension due to corroded flood waters. This for emergency service only.

5. Use of a rented Holland Furnace Company fan, the same kind that is used to clean chimneys, to dry out underground bus works after floods.

6. Hot air gun to dry out conduit after floods. This gun is made from a length of 1¼-in. iron pipe cut into the air line. High current is passed through the pipe to heat the air.

7. Old single-phase CR relay for reverse power trip of small unattended hydro station. This trip functions when all the water has been used up and shuts station down.

8. Rectox unit to facilitate the operation of old style solenoid a.c. closing oil circuit breakers.

9. Operation of a substation containing a brick structure and 20,000-kva. synchronous condenser supported partially on jacks. Mine settlements caused a serious settlement under this station and permanent jacks were placed so that station could be continuously jacked as settlement took place. To date this has totaled 18 inches.

10. Paralleling an old and a new storage battery so as to meet the requirements for additional capacity due to higher duty oil circuit breaker installations. The demand of these new oil circuit breakers is very high, some of the old batteries are not adequate for this service.

11. Use of Fresnel floodlights to illuminate restricted alleys.

12. The use of lightning arresters connected across secondary to eliminate turn-to-turn faults in type R.V. street-lighting transformers due to switching surges.

13. The application of additional wood bracing to the coils of the above type street-lighting transformers so as to prevent mechanical failures.

14. Brazing silver-plated ratio adjusters which are held together by molded plastic material by immersing the whole adjuster in a bucket of water and brazing stranded connections on the projecting lug.

15. Auto spotlight with necessary throw-over switch for emergency lighting in small substations.

16. Elimination of noise on a high-tension telephone line by applying high voltage to ground on this line so that insulators which were bad and causing trouble failed and could be discovered.

17. Use of control cable overhead on messengers instead of underground in flood areas.

18. The use of old 33-kv. and 22-kv. transformer cores out of oil to make distribution transformer tester.

19. Use of two 2,300-volt secondary transformers in series, for 4,600-volt service where no 4,600-volt transformers are available.

20. Paper tape instead of varnished cambric to retape joints of transformers and other similar oil immersed work.

21. Spare busing flanges to make adapters for various bushings so that greater interchangeability will be obtained.

22. Use of auto-transformers (small air-cooled type) to step up voltage in order to take on additional floodlighting load on existing system. In this particular system the installed cable was 600-volt insulation and originally was operated at 120 volts. It was operated at 440 volts by the use of small auto-transformers and rewiring job found unnecessary. This saved a considerable sum of money. Also it would have been impossible to obtain the wire.

Electro-Agricultural Engineers!

M. M. SAMUELS, Chief, Technical Standards Division RURAL ELECTRIFICATION ADMINISTRATION earlier this year presented a paper before the National Technical meeting of the A. I. E. E. on the subject of Electro-Agricultural Engineering, in which he said in part: "Recently there has come about a realization that every effort should be made to develop equipment to make it possible for the farmer who has electricity, to use that electricity for real farming, to get more revenue out of his farm, to produce more or better food, to preserve food and make it unnecessary to let good food go to waste."

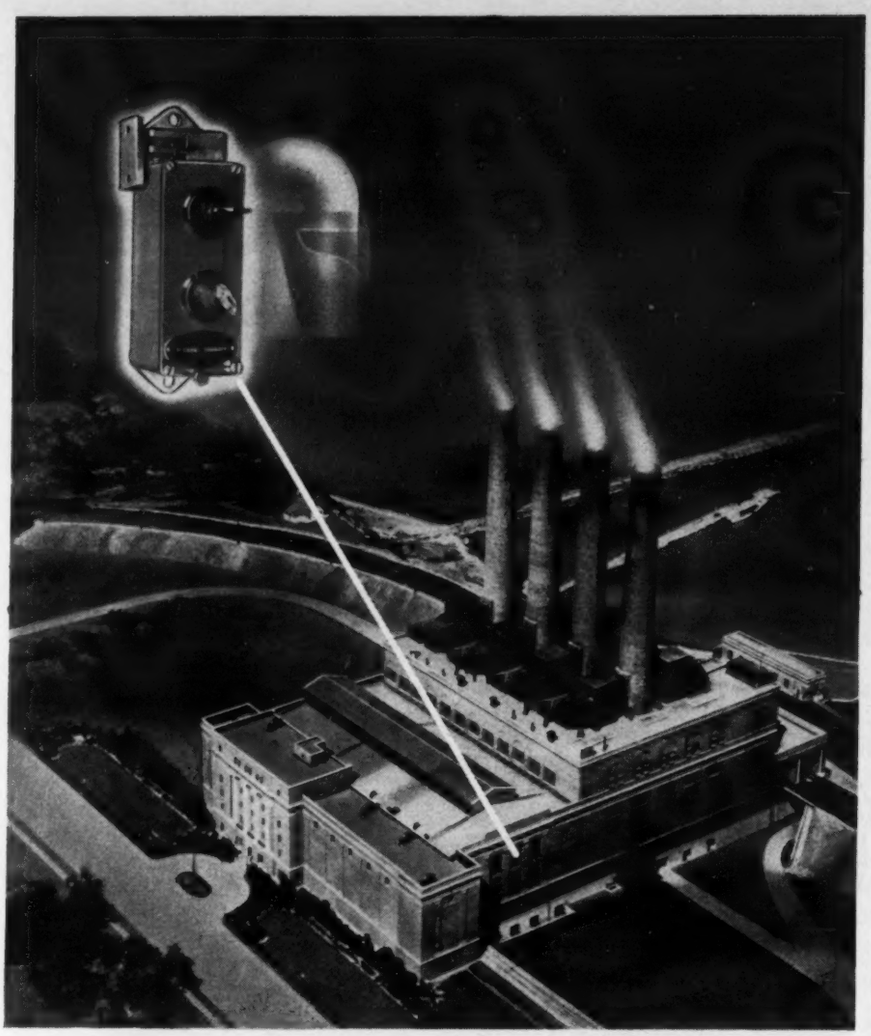
In the throes of designing and preparing for the impending industrialization of the farm, you are confronted many times with the problem of applying heat electrically. The heating element being the heart of such electrical appliances, you are concerned (even more than in home uses) with its utter dependability and its uniform and economical performance. In this work, our engineers offer cooperation.

In the home appliance field, "TOPHET", the Nickel-Chrome Resistance Wire, has long been identified with the best. Our engineers have had years of successful experience in working with resistance wire, ribbon, and strip to meet difficult and unusual specifications as to performance as well as space and shape restrictions. We gladly offer this experience to you in working out your problems.

Manufacturers of "TOPHET"
***the* Nickel-Chrome Resistance Wire.**

• ROD • RIBBON • STRIP • WIRE
RESISTANCE ALLOYS

WILBUR B. DRIVER CO.
NEWARK • NEW JERSEY



THE LOCK THAT ENFORCES THE LAW

You doubtless have adequate rules and regulations governing the use and control of dangerous equipment. But do you employ a positive, proven means of *preventing access* to such equipment until all danger has been removed?

Such protection is assured by the "BENDIX - CORY" INTERLOCK. This rugged, precision-built interlocking device, a useful member of "The Invisible Crew," is widely used in power plants.

"BENDIX-CORY" INTERLOCKS keep certain equipment or compartments *locked out of use . . . or locked in use.* They cannot be *unlocked* until the procedures you specify have been carried out, in the proper sequence, by *authorized* individuals. By eliminating the human element, they prevent mistakes and guard against lapses of memory and other causes of costly, perhaps fatal, accidents.

If you are not already using this system of proven protection both inside and outside your plant, write today for full information.

Products of this division are members of "The Invisible Crew"—precision equipment which 25 Bendix plants from coast to coast are speeding to our fighting crews on world battle fronts.

THE INVISIBLE CREW
Precision Equipment by Bendix
AVIATION CORPORATION

MARINE DIVISION • One Hanson Place, Brooklyn, New York

Cost of 115-Kv. Airbreak Switch

(From the Work sheets of an Eastern Utility)

One 600-amp., 3-pole, 115-kv. switch	$1,715.00
Labor	648.76
25 3-bolt galvanized iron clamps	8.00
3 No. 4/0 splicing sheaves	2.73
41 lb. No. 2/0 7-strand bare copper wire	6.56
4 used wishbone crossarms	16.00
1 25-ft. Southern pine pole	7.03
4 60-ft. Southern pine poles	142.00
Bolts, washers, screws, etc.	7.88
Channel iron, used, 12 in. size, 350 lb	7.00
Stores expense	18.85
Guy wire, 250 ft., ½ in. diameter	9.05
Miscellaneous items	46.06
Total cost installed:	$2,634.91

Transformer Ties In Sweden's Networks

To interlink the northern power networks with the southern power system in Sweden by a 220-kv. transmission line the problem of the most economic size of transformers had to be considered. It was found that by comparing two 60,000-kva. transformers with one 120,000-kva. unit, the latter arrangement had the advantage, according to E. Stenkvist, designer of the transformer, in "ASEA Journal" (Sweden). Savings were as follows: Copper, 17 tons; oil, 87 tons; iron and other materials, 109 tons; total, 213 tons. Another interesting fact is that no less than 240 kw. of losses were saved at full load.

Equipment furnished by ASEA's Ludvika plant was (1) a combined fan and self-cooled main transformer, 120,000/120,000/40,000 kva., 205/132 (+ or — 19.8) kv., Y-O/Y-O/tertiary delta, 50 cycles, and (2) a self-cooled regulating set, 120,000 kva. throughout 9.8/(132) + or — 9 × 1.67 percent.

Construction

Core construction of the transformer is ASEA's normal arrangement with bladed joints and three legs. With press clamps, etc., the total core weight is something over 100 tons.

Separate windings for 205, 132 and 9.8 kv. are furnished. The 205-kv. winding is built for 120,000 kva. The 132-kv. winding is suitable for full output of 120,000 kva. even when the voltage is down to 112 kv.; *i.e.*, 17.7 percent higher current than nominal.

The 9.8-kv. winding is built for use at the same time with the separate regulating set for 18,000 kva. true size

MELMAC'S ARC-RESISTANCE AND DIELECTRIC STRENGTH

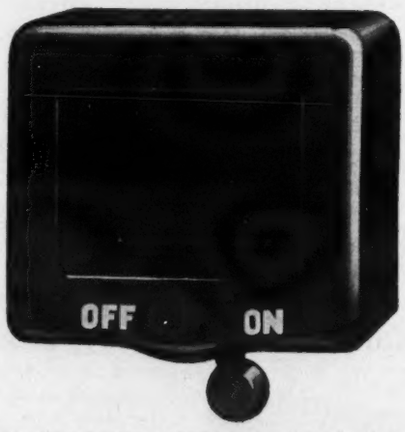
ADAPT THIS PLASTIC TO MANY NEW USES!

130 sec. (ASTM) average—that's the arc-resistance of MELMAC* and it's setting new standards of performance for plastic parts in the electrical field.

450 Volts/mil.—that's the dielectric strength of MELMAC No. 592. And another reason why this comparatively new plastic is already an "old hand" for many essential molded parts in electrical applications.

Other reasons for MELMAC's ready adaptability to electrical applications such as circuit breakers, terminal blocks, panels, parts and housings are its heat-resistance, fire-resistance and ready availability for essential civilian and wartime needs.

There are several "types" of MELMAC available to meet the varied demands of new industrial applications. Write us for further information on this new group of thermosetting molding materials developed by Cyanamid's research. Our experienced technical staff will help you in adapting the advantages of MELMAC to *your* requirements. Test pieces on which to make your own tests will be supplied on request.



CIRCUIT BREAKERS, terminal blocks, switch plates, instrument panels . . . are but a few of the electrical parts in which arc-resistance and high dielectric strength of MELMAC are outstanding advantages.

AMERICAN CYANAMID COMPANY
PLASTICS DIVISION
34 ROCKEFELLER PLAZA, NEW YORK, N. Y.
** Reg. U. S. Pat. Off.*

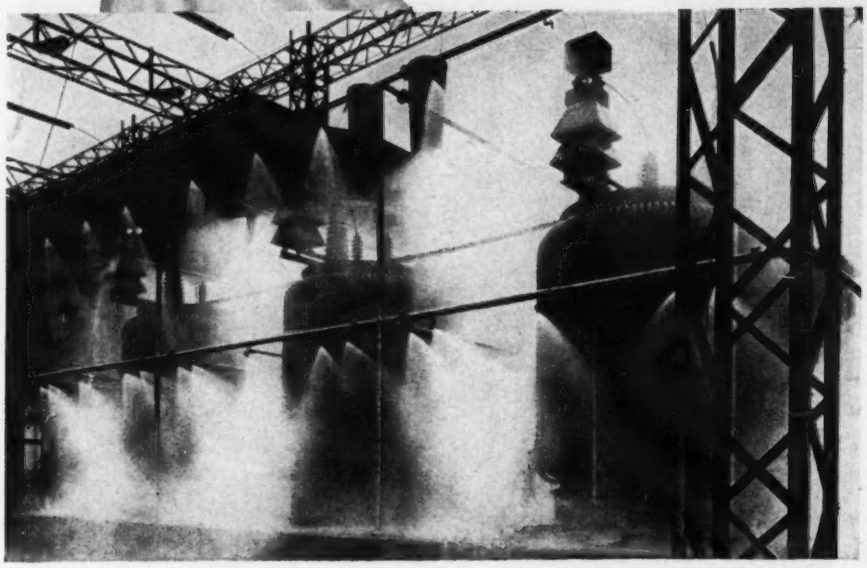
BEETLE • MELMAC

CYANAMID PLASTICS

WAR PRODUCTION

depends upon

a continuous POWER SUPPLY



Protect your oil-filled equipment from FIRE with a GRINNELL MULSIFYRE SYSTEM

MULSIFYRE SYSTEMS operate on the principle of mulsifying blazing oil with a driving spray of water. The oil is turned into a liquid which is incapable of burning. A Mulsifyre System extinguishes fire in a few seconds and prevents reignition.

Complete separation of water and oil takes place in a few hours . . . leaves oil undamaged.

There is absolutely no conductivity along the discharge of a Mulsifyre projector when spray strikes conductors carrying high voltages.

Mulsifyre Systems are permanently installed . . . they operate automatically and manually.

Recommended by Underwriters' Laboratories for use in extinguishing fires in flammable oils immiscible with water, wherever such oil is a fire hazard . . . in transformers and other oil-filled electrical equipment.

Investigate this simple, sure oil fire protection. Write for Data Book by Underwriters' Laboratories. Grinnell Company, Inc., Executive Offices, Providence, Rhode Island. Branch offices in principal cities of U. S. and Canada.

GRINNELL

MULSIFYRE SYSTEMS

For Production Protection

(not "passing through" size) and also with a synchronous condenser of 40,000 kva. at zero power factor.

Winding insulation corresponds to 1,130, 680 and 100 kv. insulating levels for the 205, 132 and 9.8-kv. windings, respectively. Impedance between the 205 and 132-kv. windings has been kept down to 11.1 percent at 120,000 kva.

Four 220-kv. condenser type terminals are furnished on the high-tension side of the transformer. The bushings are arranged so that the dielectric losses in the condenser body can be measured with the bushing flange insulated from the tank or by an inverted Schering Bridge.

The tank instead of having a rectangular or oval form has sides following the rounding of the windings and there are no large flat surfaces. By arranging the joint between the tank and the cover slightly above the transformer core and by the use of a special bottom construction, it has been possible to keep within the transport height.

Cooling

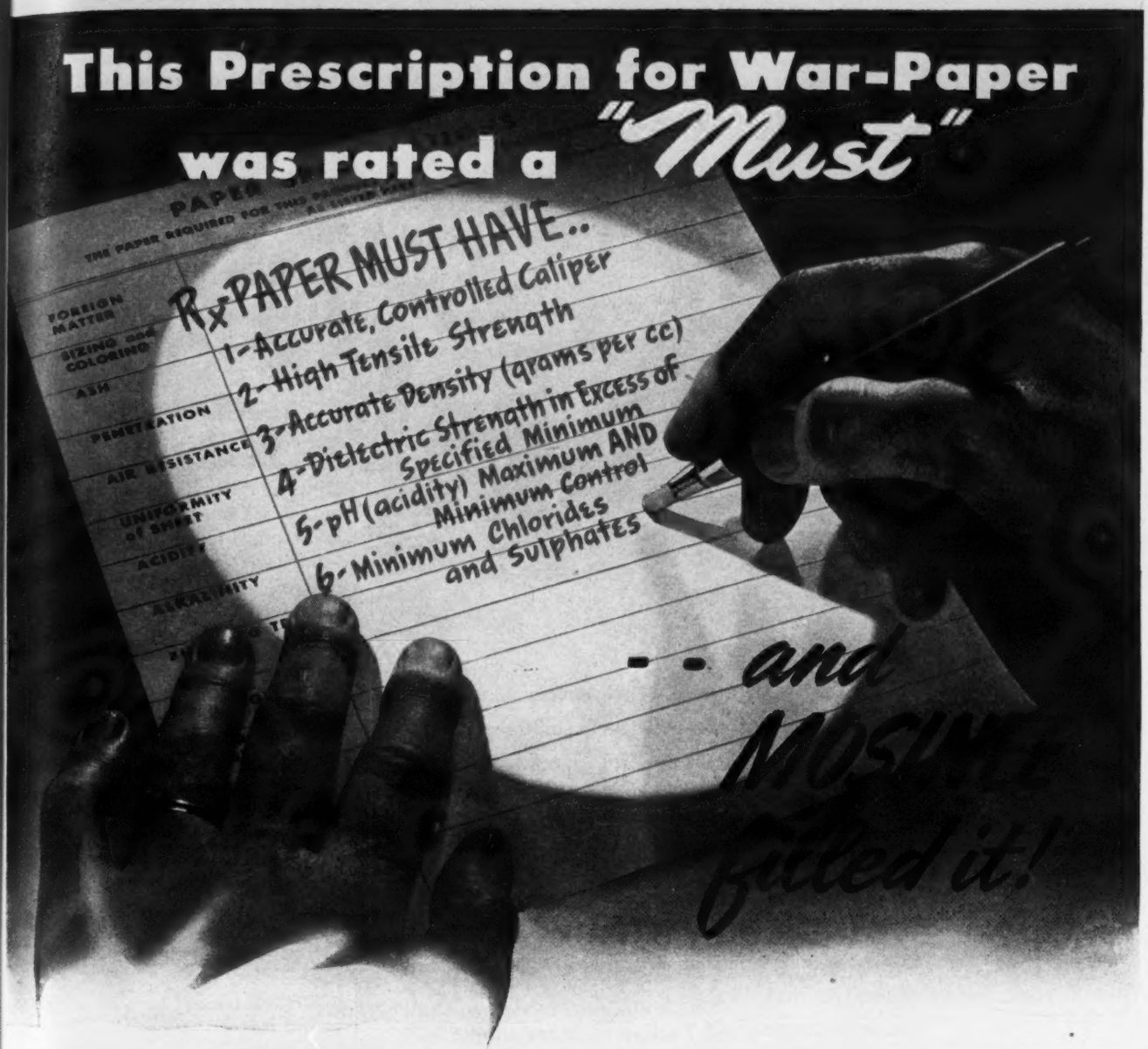
Forced cooling is provided by eight built-in fans which are arranged in two groups and remotely controlled by thermometers which operate on the temperature of the primary windings. When the temperature reaches 70 deg. C. one group of fans start, and if the temperature should rise to 80 deg. C. the second set of fans are operated.

Protective devices on the transformer are: Gas relay signal; magnetic oil level indicator; two explosion devices; reverse flow device in oil pipe between transformer and expansion vessel; dial thermometer for indicating top oil temperature; three resistance elements for indicating maximum temperature in the three corresponding windings.

Some physical and electrical characteristics are: Over-all length over cooling tubes, 37 ft.; over-all breadth over cooling tubes, 19 ft. 6 in.; greatest height from plinth to top of terminals, 26 ft. 9 in.; weight of complete transformer without oil 219 tons, with oil 298 tons; measured efficiency at 120,000 kva., 205/132 kv., 99.4 percent; no load losses, 262 kw.; no load current, 1.22 percent.

For transportation, the transformer was prepared so that the weight was 162 tons. Total weight, including a

This Prescription for War-Paper was rated a "Must"



Manufacturer X had sold a product fabricated with paper made according to a prescription approximating the above. It had stood up for years under every test. Then came the war!

When used in certain new war weapons, the product failed. What was wrong? Study and analysis indicated that the cause of the failure was in the paper. The maximum limit of one of the ingredients, formerly ignored, now became the deciding factor of success or failure. Prompt adjustment in processing the paper, rewriting the prescription and establishment of control for the new limitation, prevented further failures . . . Perhaps you have a "paper prescription" that needs rewriting. Our engineers will contact you, at your request, to consult with your technicians. No obligation.

Please address your letter "Attention Dept. B"

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

These Frahm Resonant-Reed Tachometers have taken a beating. Designed for permanent mounting, they have been used as portable instruments, continuously for 22 years, on the test floor of a turbine manufacturer. When returned to us for repair and recalibration we found that, except for one reed which had been broken, no reed registered more than 2% out of calibration and nearly all were correct within 1%. The instruments have been repaired and are now back in the same hard service.

Frahm Resonant-Reed Tachometers are simple and rugged in construction . . . accurate and dependable in operation. With no parts to wear, adjust, lubricate or renew they give years of trouble-free service. Built in types for permanent mounting, and for hand use in servicing, testing, installation and maintenance work. Various ranges available from 900 to 30,000 R.P.M.

For a complete description of the Frahm Tachometer together with list of types and ranges commonly supplied, write for Bulletin 1590W.

The same instruments shown above, after repair and recalibration in the Biddle Repair Department.

JAMES G. BIDDLE CO. • 1211-13 ARCH STREET PHILADELPHIA, PENNA.

10-axle railway car, was 215 tons. The axle weight exceeded that normally allowed on the Swedish Railways; consequently the special train was not allowed to exceed 3 to 6 miles per hour and was run only at night.

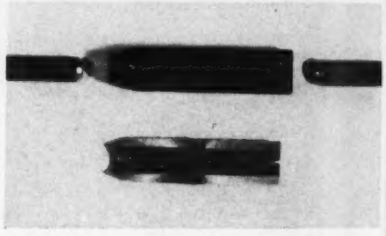
•

Ground Rod Assembled in Sections*

By W. C. SCHMIDT
Commonwealth & Southern Corporation, Jackson, Mich.

A design factor of great influence on the performance of a transmission line is the impedance of the connections to earth. In the desire to reduce the footing impedance to an economic minimum use has been made for some years of single sectional rods of rather long lengths instead of short rods driven in multiple.

These ground rods, of ⅝ in. diameter, are of black copper-bearing steel, usually in 8 or 12-ft. lengths, and are joined by means of drive-fit couplings. Sectional details of the



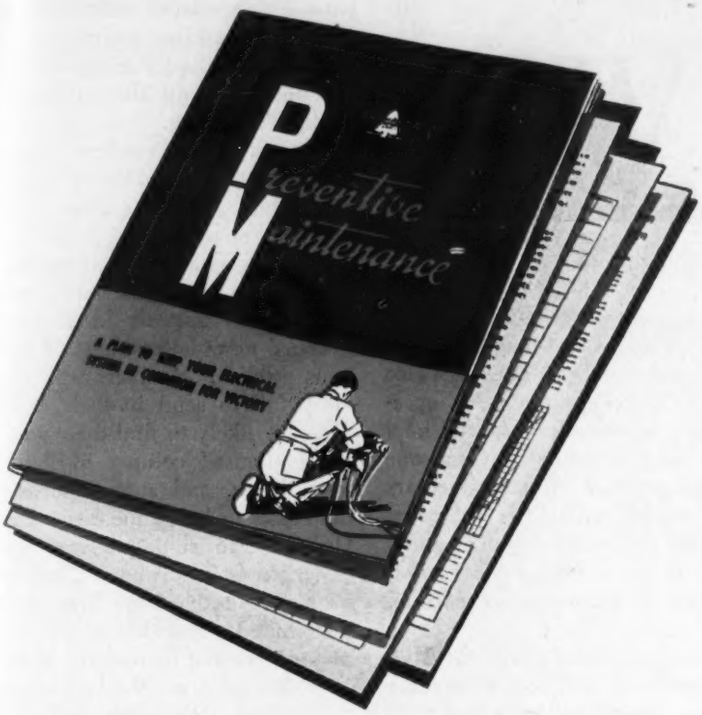
COUPLING (center) for joint of sectional ground rod

coupling show the longitudinal serrations which form the tight joint. Specimen joints have been tested after driving to determine fit of the couplings, and with rods varying from 0.620 to 0.630 in. diameter, the holding power of the couplings is from 4,000 to 4,600 lb.

With couplings of such design it is very necessary to control the fit between coupling and rod so the rod will seat properly in the coupling under either easy or hard driving conditions. The only machining necessary on the rod is to bevel each end slightly in order to remove the burr caused by the shearing operation.

A method and the depth of driving the rods will be presented in a subsequent article.

*Excerpt from paper presented at recent E.E.I. transmission and distribution committee meeting in Pittsburgh.



OVER 36 UTILITIES

are using the PM plan to spearhead service campaigns

Introduced a short time ago, Anaconda's Preventive Maintenance Plan is being widely used by utilities to help customers keep electrical systems operating *efficiently*—despite shortages in essential wiring equipment.

Already some 36 utilities are actively engaged in this program. With it, they are helping their industrial power customers maintain continuous wartime production by preventing electrical breakdowns.

1 WHAT THE PLAN IS

The PM plan is a simple but comprehensive way to safeguard war production by preventing electrical breakdowns *before they develop.*

2 HOW IT WORKS

The plan provides a practical means of making periodic, systematic analysis of circuits and equipment. Uncovers potential weaknesses . . . suggests ways to correct them . . . prevents overloading of lines.

Data thus gathered aids local W.P.B. Branches in reaching decisions on requests for materials to *prevent* breakdowns.

3 HOW UTILITIES BENEFIT

The PM plan helps utilities maintain close customer contact despite a lack of "something to sell." Offers basis for service campaign that definitely appeals to customers. Puts the utility in a leadership role for furthering war production throughout the area it serves.

If you aren't already utilizing the Anaconda Preventive Maintenance Plan, mail the coupon for full details. 43233

"Tomorrow may be too late . . . do it today!"

ANACONDA'S PREVENTIVE MAINTENANCE PLAN

ANACONDA

Anaconda Wire & Cable Company
25 Broadway, New York City

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding wartime production.

Individual .....

Company .....

Address ..... City .....

6L

LOAD SERVICING

Industrial • Commercial • Rural • Residential

REA Experience With Postcard Readings

By ROBERT B. CRAIG
Deputy Administrator, REA

About three-quarters of a million consumer-members of the rural electric co-operatives financed by REA now read their own watt-hour meters and return the readings to their co-op offices, with important savings for the co-ops in labor, expense, tires and gasoline.

Most co-ops have found from experience that more than 90 percent of their members read their meters on time—and with rare exceptions read them accurately. As tire and gas shortages reduced mileages of employee readers, more and more of the REA groups switched to self-reading as a virtual necessity.

A week or so before bills go out to the metered consumers the co-op mails to each consumer a return postcard, with his account number shown for identification purposes. On the meter-reading date, the consumer enters his present meter reading, signs the card and mails it in to the co-op. The cards start coming into the office the same day, permitting checking and billing to start at once.

Some systems go even further; they send out, just before the first of the year, a marked calendar with a year's supply of meter cards for their members to tear off, fill out and mail when each month's reading date falls due as indicated on the calendar. This eliminates monthly mailing by the co-ops. The calendar sometimes indicates also the last day to pay the bill without penalty.

A few REA borrowers have launched self-billing systems, in which the consumer reads his meter, computes his bill and sends both reading and payment in the same mail. This has proved generally successful when initially installed on new systems, but the plan has not yet been widely tried.

Check readings are made, without notice to the members, once or twice a year. Errors are few. An occasional zero or two slips into the final reading as a member confuses one digit with another. But such errors can be traced with little difficulty. The errors favor the supplier about as often as the consumer—conscious misreading is almost never encountered.

Some co-ops, especially in the Midwest, instituted self-meter reading when they were organized a few years ago, and have never considered any other method. Others have found by actual comparison that the cost of penny postcard reading is far cheaper than the time, mileage and wages spent per individual meter by an employee reader. In general, those systems which started with a self-reading plan found its operation smoother than those which changed over to consumer reading after starting with employee reading.

Success of self-reading hinges on the prompt return of the cards, as well as on their accuracy. Most members of REA co-operatives have become thoroughly aware of their responsibilities in this respect, through constant notices and appeals in the mimeographed news letters most of the systems publish. Members who consistently fail to send in their cards on time are likely to find their names in a "doghouse" column of the co-op news letter, and such notoriety seldom fails to bring the desired result. One Eastern co-op reduced its late meter cards from about 15 percent to around 6 percent the first month it distributed a news letter, and down to about 2 percent thereafter. More positive, however, are the logical appeals to members that failure to return the cards promptly means only added bookkeeping by their own employees—the office staffs of the co-ops—and therefore added expense to themselves.

• • •

Bottlenecks Taboo

Malden (Mass.) Electric Company featured WPB's booklet on industrial lighting and extracts from General Electric's production illumination diagrams in a recent window display which brought numerous inquirers into the office to obtain these publications and advice from the utility lighting engineers on how to better conditions in war plants and other establishments. Emphasis on poor lighting layouts and means of improving them to secure faster production, reduced spoilage and increased eye comfort for employees were the keynote of the display.

WAR STAMPS

Will Put You Back in the APPLIANCE BUSINESS

with the APPLIANCE RESTORATION PLAN

ENTHUSIASTICALLY SUPPORTED BY THE WAR SAVINGS STAFF OF THE U. S. TREASURY DEPARTMENT.

SAVE TO SAVE AMERICA—BUY MORE WAR BONDS AND STAMPS

Opportunity knocks! This is your chance to help your country, your fellow-citizens and yourself.

American homemakers desperately need electrical appliances—to replace appliances beyond repair, to provide appliances for new family units, to lighten the burden upon war-workers who must through necessity do their own housework, and to replace human labor diverted into essential industries. Great as the need is it's no secret that no new electrical appliances can be made. But the situation is far from hopeless.

VAST STOCK PILE OF USABLE APPLIANCES WAITING TO BE RESTORED TO SERVICE

In the last 15 years, 179,054,292 small electrical appliances, including 50,848,648 irons, have been sold. These figures show there must be thousands of these appliances lying *idle*—in attics, in cellars, forgotten shelves or drawers. *The pertinent point is that most of these out-of-use appliances are repairable. They must be rooted out, restored to serviceable condition and put in the hands of millions of women who desperately need them.*

HERE'S HOW TO DO IT

1. Buy these restorable out-of-service appliances.
2. Pay for them with WAR STAMPS.
3. Restore them to usable condition.
4. Re-sell them to those who need them.

EVERYBODY BENEFITS FROM THIS PLAN

Original owners of appliances get War Stamps and help others; purchasers get appliances they need and could not buy otherwise; service stations or departments get paid for repairs; dealers get a selling profit; utilities perform a noteworthy, patriotic service; Uncle Sam sells War Stamps; distributors build up future purchasing power for appliances.

Developed by the Proctor Electric Company and presented as a contribution to America's War Effort

START NOW—COMPLETE DETAILS READY

Utility company executives and electrical leagues are urged to write for complete details immediately.

PREPARE YOUR OWN INDIVIDUAL CAMPAIGN with the help of the Appliance Restoration Plan Book and "Action Check List" which explain what this plan is, what it will do, and how you can put it to work immediately.

ADVERTISING IDEAS—Sample layouts to help you prepare advertisements that will pied-piper thousands of these idle appliances from their hiding places.

DISPLAY IDEAS—A suggested compelling window streamer that will stop passers-by and pull owners of idle appliances into your store for the details.

STAMP BOOK ENVELOPE—A simple way to earmark the War Stamps as the first down-payment for the purchase of that after-the-war iron or toaster.

RESALE TAG—A suggested attractive resale tag which certifies that the appliance was bought from its owner with War Stamps and that it has been restored to satisfactory, usable condition.

APPLIANCE *RESTORATION PLAN*

PROCTOR ELECTRICAL APPLIANCES

PROCTOR ELECTRIC COMPANY, *Div. Proctor & Schwartz, Inc., Philadelphia*

UTILITY and ELECTRIC LEAGUE EXECUTIVES

ASK YOUR SECRETARY TO FILL OUT AND MAIL THIS COUPON TODAY

PROCTOR ELECTRIC COMPANY
Div. Proctor and Schwartz, Inc.
Third Street and Hunting Park Avenue
Philadelphia, Pa.

Please send me at once complete information about the Appliance Restoration Plan and your suggestions for our participation in this nation-wide appliance sharing movement.

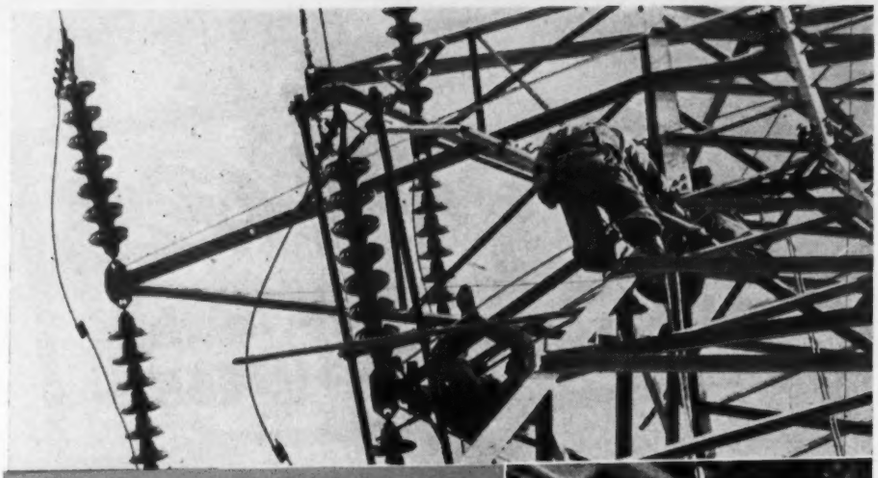
Name of Utility or Electric League .....

Name .....

Title .....

Address .....

City ..... State .....



Changing tower insulators "hot" with TIPS TOOLS

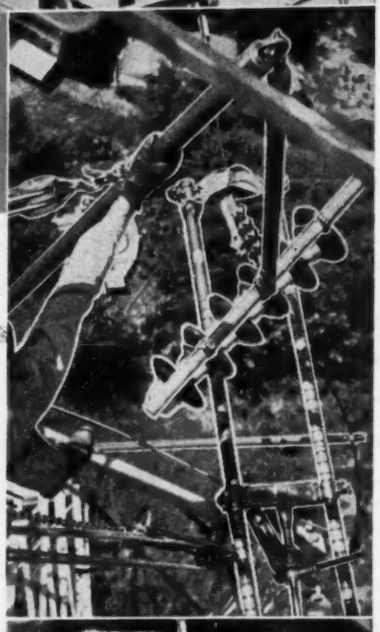
Boom pole attachment saves time

With a little experience and the right equipment, hot line crews can replace defective tower insulators in short order without interrupting service.

The procedure for handling this type of maintenance work is illustrated here. A double pole Strain Carrier is mounted over the conductor astride the insulators and attached to the tower arm with a Strain Jack and Tower Arm Bracket. The ratchet jack relieves the strain from the insulators. By using a Tips wire tong saddle clamp and tower leg saddle, a wire tong can be used, as shown here, for a boom pole. For heavier strings a Tips Boom Pole should be used and attached in the same manner. This is a simple, quick method for attaching a boom. (See closeup at lower left.)

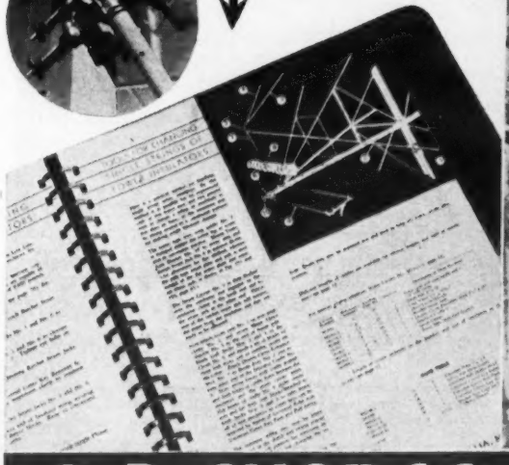
A Tips Cradle is next attached to the boom by a special insulated link. (Here an ordinary "link stick" was used.) The Cradle is lowered into place under the insulators and when the insulators are detached by means of cotter key removers, they are swung in to the tower for changing broken units. (See second photo.) When changes are made the reverse procedure completes the job.

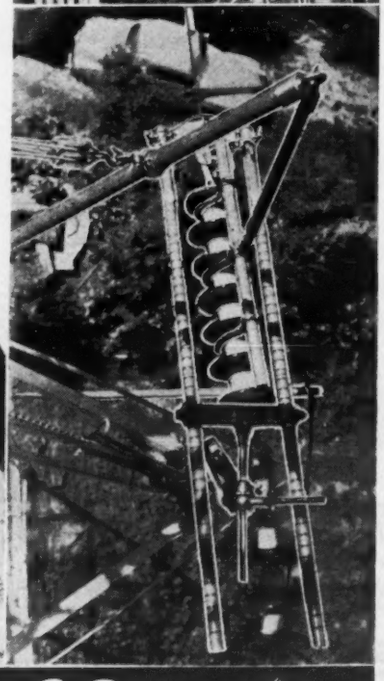
By the use of these well insulated, smooth working tools, two tower men with ground crew assistance can change a string of insulators in less than forty minutes including the time required to hoist and mount equipment.



You'll find complete details on page 29 of your Tips Catalog.

CONSULT THIS BOOK





A·B·CHANCE CO·
CENTRALIA, MISSOURI.

ABC INDUSTRIES

Farmers Swap Electrical Equipment

Proved successful in a trial test, a swap service for the exchange of farm electrical equipment and appliances is now being offered to farm customers throughout the western part of New York State by the Niagara, Lockport & Ontario Power Company, a subsidiary of the Niagara-Hudson System.

Last fall, in an effort to assist farmers in keeping production moving despite labor shortages and curtailed farm equipment, the company originated its novel swap idea and tried it out in its Avon district, near Rochester.

The plan took cognizance of the fact that on some farms electrical equipment was lying idle, while on other farms it was sorely needed. In order to obtain the necessary information as to where the spare equipment was and whether or not there was a demand for it, the company sent a letter to 1,100 of the most progressive farmers in the area.

In this letter the farmer was given an opportunity to list with the power company any used equipment which he no longer needed and also to put in his request for equipment which he did need. With the equipment he wished to dispose of, he could state how he wanted the transaction handled—by sale or swapping.

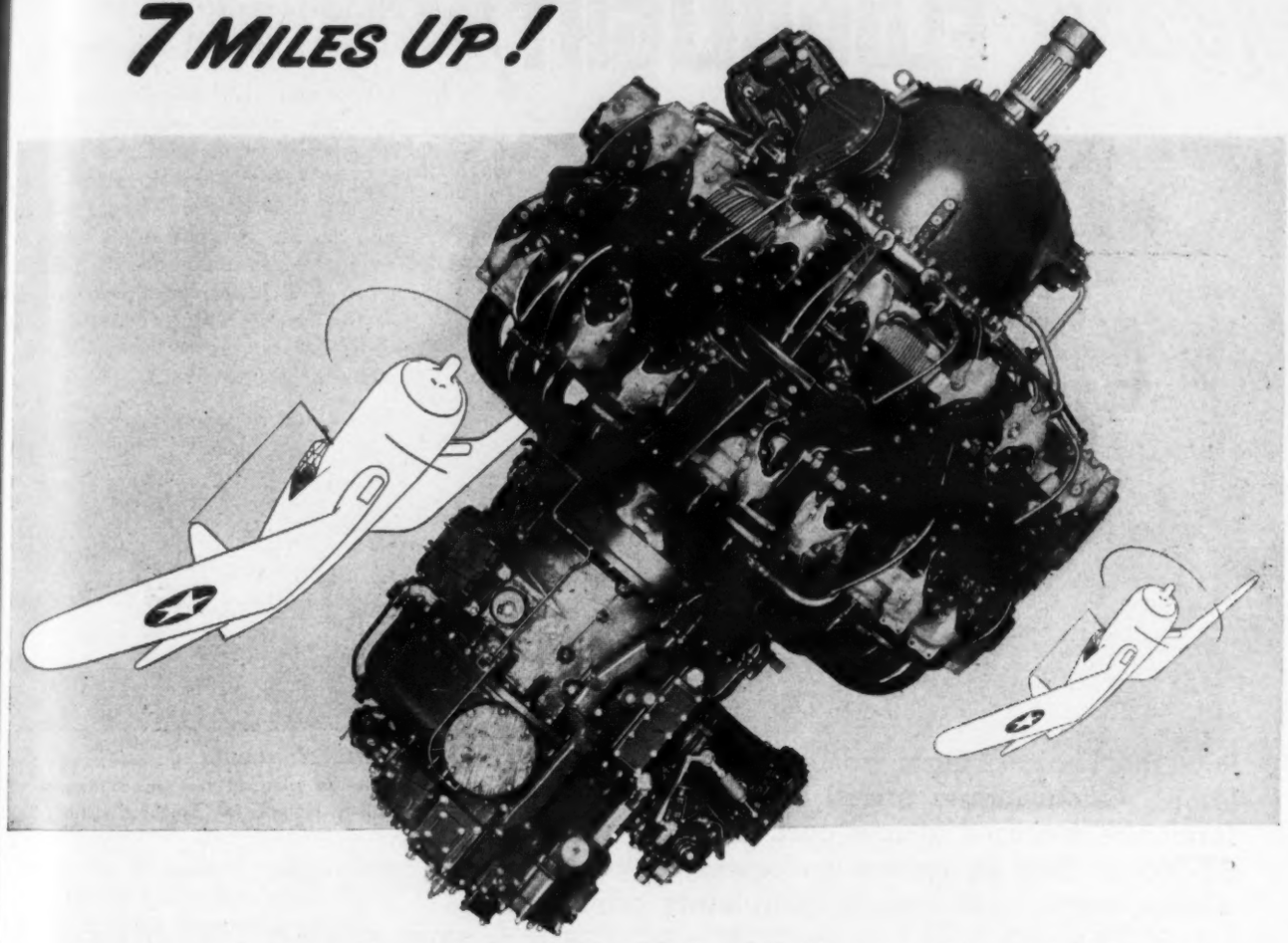
The company then attempted to match up requests and offers and to get Farmer Brown, who wanted to sell, in touch with Farmer Jones, who wanted to buy. It was tactfully stated in the letter that all transactions were to be made by the individuals themselves.

Fourteen Equipments

A 7 percent return resulted from the mailing and from that return fourteen pieces of idle equipment went to work again. These included poultry water warmers, dairy water heaters, motors, milk coolers and chicken brooders. The farmers, according to the company, had a lot of fun swapping when they went to work on each other to effect the exchange.

"The trial was so successful," says Morris H. Lloyd, rural service supervisor for the Niagara, Lockport & Ontario Power Company, "that we are now extending the same service to farmers in Erie, Cattaraugus,

7 MILES A MINUTE
7 MILES UP!



WHAT you see before you is one of the world's mightiest naval aircraft engines—built by Nash-Kelvinator!

Packing 2,000 horsepower into 18 double row radial cylinders, this great Pratt & Whitney air-cooled engine is the fighting heart of the U. S. Navy's new Vought *Corsair*—the fastest, most deadly carrier-based plane ever to take to the sky!

Already in combat with the enemy's Zeros . . . the Japs' best . . . the *Corsair* has proved its superiority—its ability to outfly, outclimb and outfight all competition! For it is capable of a speed of nearly seven miles a minute in level flight! It can fight at altitudes over seven miles above sea level! And that gives it the "drop" on Axis pilots, as they are learning to their everlasting sorrow!

One of the miracles of this engineering and manufacturing masterpiece is that . . . with all its more than 10,000 separate parts . . . its high-altitude supercharger . . . its 2,000 horsepower . . . it weighs only slightly over 2,400 lbs.!

This is one of Nash-Kelvinator's wartime tasks. We are proud that our tradition of precision workmanship can be depended upon on the battlefronts of the air, as it is in the homes of America.

• • •

Noteworthy is the fact that the Kelvinator Polarsphere Sealed Unit—which we believe to be the most trouble-free unit in the industry—has for years been built to the same exacting standards now employed in building the 2,000 horsepower engines for the Navy's Corsair!

SCRAP IS POWER

Cooperate With Your Industry! Salvage All Inoperative Parts Containing Critical Materials . . . Put Vitally-Needed Scrap Back Into the Scrap TODAY!

[*KEEP 'EM FLYING! BUY MORE WAR SAVINGS BONDS AND STAMPS!*]

LOOK AHEAD WITH KELVINATOR

DIVISION OF NASH-KELVINATOR CORPORATION, DETROIT, MICHIGAN

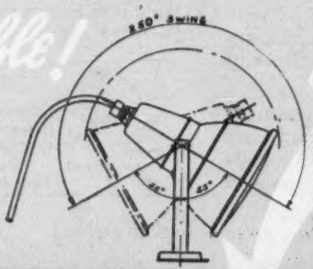
NEW LOW-PRICED Permaflector 200 WATT FLOODLIGHT!

Powerful beam of light from a standard 200-watt lamp! Offers higher priced mechanical and performance features at low cost. Built to "take it", ST-200 is ideal for service on power shovels, bulldozers, trucks and cranes; completely adjustable.

SHOCK and WEATHER-PROOFED

Silver-mirrored glass PERMAFLECTOR; housed in corrosion-resistant sheet steel; convex, stippled, heat-resisting, 8⅜" lens; porcelain socket; weatherproof cord grip fitting. 12½" high overall; weighs only 6½ lbs.

Adjustable! Data!



250° swing vertically, 360° horizontally, by adjusting wing nuts on bracket and base.

200-watt PS-30 Incandescent Lamp

Beam spread	50°
Overall spread	145°
Lumen output	2565
Beam candlepower	7400

PITTSBURGH REFLECTOR CO.

MANUFACTURERS OF LIGHTING EQUIPMENT AND THE FAMOUS Permaflectors

OLIVER BLDG. PITTSBURGH, PENNA.

Please rush complete data on small-wattage PERMAFLECTOR Floodlight ST-200 — *EW 6-43*

NAME.....

ADDRESS.....

CITY..... STATE.....

Chautauqua, Niagara, Genesee, Orleans, Allegany and the other counties we serve in western New York."

•

Nutrition Popular With Men's Groups

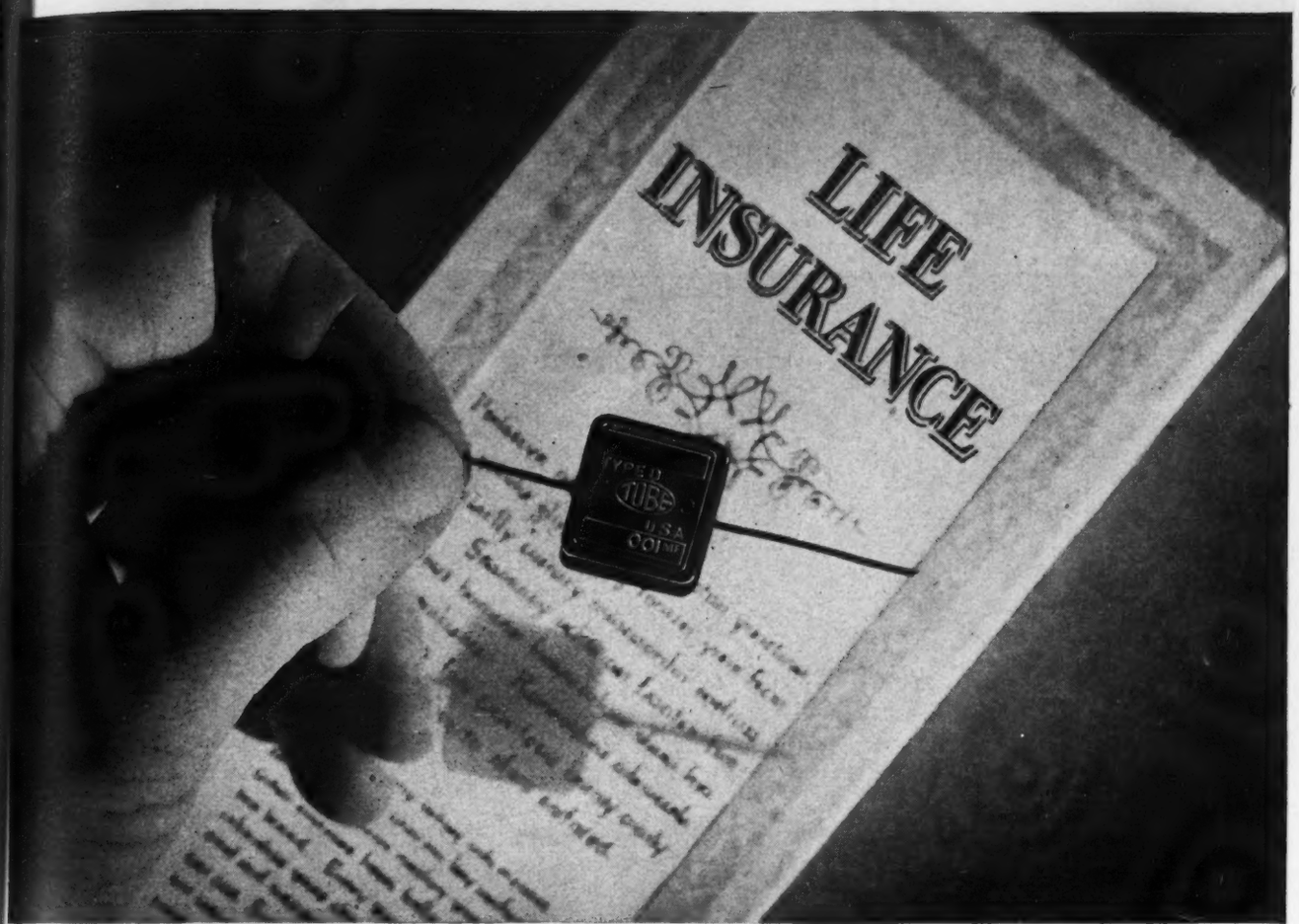
War and food rationing has lifted nutrition out of the realm of cooking schools for women and into the spotlight of public interest. Home service activities of the Wisconsin Public Service Corporation have in recent months paced the shift in interest with a half-hour digest of essential nutrition information. The short demonstration lecture has become a popular feature at weekly

BALANCED SCALE demonstrates principle of planned diet in condensed nutrition lecture for luncheon clubs

and monthly meetings of civic groups, men's clubs and school groups.

Eighteen groups, varying all the way from a dental hygienist gathering in Green Bay through Rotary, Kiwanis and Lions clubs to a business college assembly in Oshkosh, have scheduled the talk. In two months nine men's groups, six predominantly women, two school gatherings and one with mixed adult attendance have been visited for a total attendance of 1,150.

The presentation, using colored charts, is a condensation of Westinghouse and government nutrition information interspersed with original data. One popular feature is the "food balance," shown, designed by Miss Kathryn Heffermen of the Green Bay home service organization. It is a simple demonstration that depicts graphically the need for all essentials in the balanced diet. Along the top of a balanced rod, with a removable symbol representing each, are the different food elements of a balanced diet. As an element of the perfect diet is removed the balanced scale is



NOW AVAILABLE FOR YOUR PRODUCTION REQUIREMENTS!

The first oil-impregnated condenser to be found physically and electrically interchangeable with the majority of mica capacitors used in the by-pass and coupling circuits of radio and radar equipment.

The Tobe Type DP Molded Paper Capacitor has *long life built into it* through every step of manufacture. Rigid inspections maintain a standard that is exceptionally high—so high, in fact, that "returns" are almost completely unknown.

For the first time since its introduction we are *now* in a position to accept immediate orders for Type DP, with *prompt delivery assured.* They will be filled in order of receipt and we suggest you act promptly. For production samples or further information write TOBE DEUTSCHMANN CORP., CANTON, MASS.

SPECIFICATIONS—TYPE DP CAPACITOR

CAPACITANCE	.001 to .01 mfd.
WORKING VOLTAGE	600 volts DC—flash test 1800 volts DC
SHUNT RESISTANCE	At 185° F.— 1000 megohms or greater
	At 72° F.—50000 megohms or greater
WORKING TEMPERATURE RANGE	Minus 50° F. to plus 185° F.
OPERATING FREQUENCY RANGE	Upper limit 40 megacycles
	Q at one megacycle—25 or better
POWER FACTOR	At 1000 cycles—.005 to .006

These capacitors meet Army and Navy requirements for immersion seal.

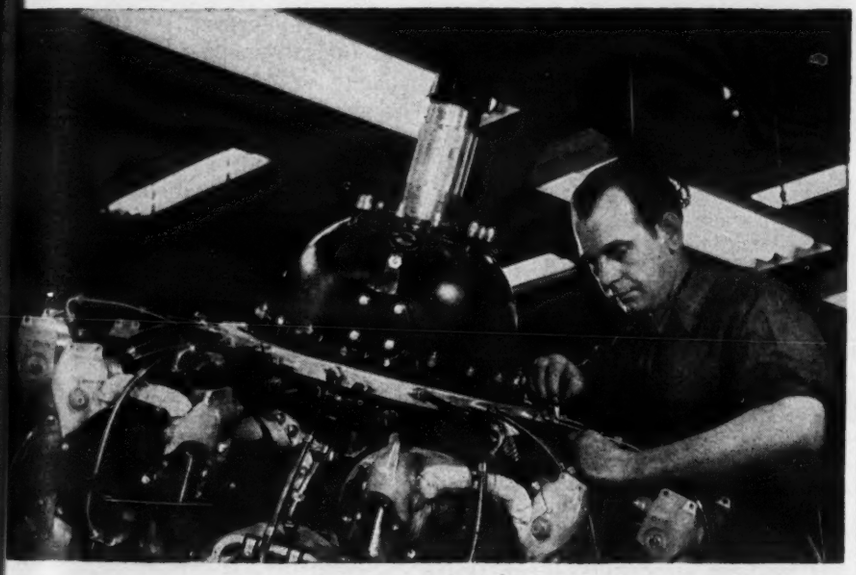
TOBE DEUTSCHMANN CORP. TOBE CANTON · MASSACHUSETTS

"SEE-ABILITY" helps

Off the line—ahead of time! "See-ability" through modern lighting saves time in assembly, inspection, and final test.

ps build motors faster

Motors are coming off the lines, faster and faster... ich a promise of Victory—ahead of schedule. • To sure the success of this vital war work, millions of Vestinghouse Mazda lamps are needed daily—needed o provide better "See-ability" for all our workmen in oundries, machine shops, in production and inspection epartments everywhere! To make these lamps available, e must draw upon limited supplies of nickel, copper, ngsten. • That's why, in our advertising, we are asking ll users to conserve their lamps, to help stretch further he nation's supply of critical materials. Westinghouse lectric & Mfg. Co., Lamp Division, Bloomfield, N. J.



"SIGHT FOR VICTORY" PROGRAM

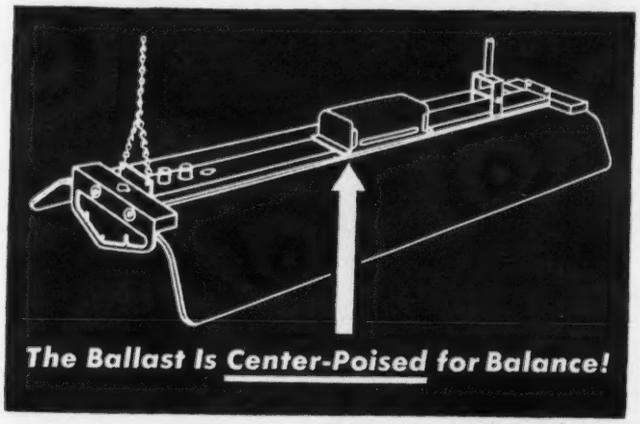
Everyone interested in speeding our war effort through improved "See-ability" for war workers, can help by cooperating with the National Better Light—Better Sight Bureau's *"Sight for Victory"* Program. For full details, write Westinghouse Electric & Manufacturing Co., Lamp Division, Bloomfield, N. J., or get in touch with the Better Light—Better Sight Bureau, 420 Lexington Ave., New York, N.Y.

Westinghouse

MAZDA LAMPS

FOR GREATER "SEE-ABILITY"

Study the Features of this Amazing Unit!



1. **MASONITE REFLECTOR-BOARD REFLECTORS** —Conform with WPB Steel Limitations.
2. **EXPOSED BALLAST,** for cooler operation and longer ballast life.
3. **EXPOSED STARTERS** can be removed without removing lamps.
4. **GROOVED CHANNEL** reinforces channel, also used with sliding hangers.
5. **BUILT-ON CHAIN STRAPS**—intregal part of channel assures "center poise" ride of ballast in Fixture.
6. **BUMP-PROOF ENDS** — stamped with recessed panel reinforcing to insure lampholder protection.
7. **TWO-END KNOCKOUTS**—combination knockouts for locking units together or for pull switches.
8. **FOR EGGCRATES**—slot in standard ends for attachment of new eggcrate louvres.
9. **LINE-UP HOLE** — use when desired with bolt and nut for perfect line-up continuous runs.

Leaders in Lighting Since 1902 Guth

THE EDWIN F. GUTH CO. • 2615 Washington Ave. • St. Louis, Mo.

upset and equilibrium restored only by the return of the missing element.

Effect of the short luncheon lecture has been to "point up" interest in the "Health for Victory" course given by the company to employees of industrial concerns in the Green Bay area. In several cases men hearing the short lecture have asked that the full course be given to people at their concerns.

•

"Animal Unit" Farm Extensions Planned

Within the next three months Connecticut Light & Power Company plans to build between 12 and 15 miles of rural line extensions under WPB Order P-46-c, following a program prepared over a year ago by H. D. Larrabee, eastern division manager of the utility, Norwich. At the time Mr. Larrabee worked out his plan the construction of power line extensions to farms was prohibited by the WPB to conserve vital material, but it was foreseen by the utility that a future scarcity of food and farm labor would present a serious problem, the solution for which, in part, would be to substitute electrical energy so far as possible for manpower on farms. It was also believed that where material used for construction would serve food production in sufficient quantity, the expenditure of such material would be justifiable.

The basis of the C.L.&P. plan was to use livestock as the test whether or not extensions should be made. Long experience as manager of a division serving many farms helped Mr. Larrabee to reduce livestock of different kinds to the common denominator "animal unit." The plan required that a minimum number of animal units be served per 100 ft. of extension built. Under Preference Order P-46-c, which also uses animal units as a basis, a farm must support one milk cow, ten beef cattle, 75 hens or other livestock in equivalent proportions for each 100 ft. of new line required. Last fall the plan was submitted to the WPB by Frank M. Reinhold, assistant purchasing agent of the C.L.&P., who is chairman of the company's priorities committee. More than 66 percent of the new lines will be in the eastern division of C.L.&P.

How O.S. untied a knot in a steel mill turbine

IF THERE'S a tougher type of turbine to lubricate than a turbo blower in a steel mill, we haven't heard about it. No wonder one of the country's large steel producers couldn't get turbine oil to last longer than 6 months!

But in November, 1940, this manufacturer filled one of its turbo blowers with the then new Shell Turbo Oil. The phenomenal result is shown at right. After 18,553 hrs. of operation Shell Turbo Oil still shows no signs of deterioration. This performance is the reason Shell Turbo Oil is now used in 14 turbines of this steel company.

For further details on this and other outstanding performances of Shell Turbo Oil call in the Shell man. Or, write Shell Oil Company, Inc., Dept. "C," 50 W. 50th St., New York, N. Y., or 100 Bush St., San Francisco, Cal.

CERTIFIED PROOF OF THE SUPERIOR

OXIDATION STABILITY

OF SHELL TURBO OIL

156	CHARACTERISTICS	156
Clear	Appearance	Clear
LT .05	Neutralization No.	LT .05
LT .2	Saponification No.	.2
90	Steam Emulsion No.	90

Performance record of Shell Turbo Oil in one of the fourteen units of a large steel producer.

SHELL TURBO OIL

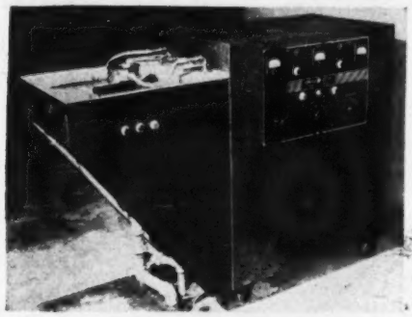
Currently, the U. S. Navy has first call on Shell's entire production of marine turbine oil.

SHELL

NEW EQUIPMENT

Electronic Heaters

A line of electronic heaters has been developed for high-frequency induction heating of metal parts for brazing, soldering and selective heat treating. The oscillator circuit used on both sizes of



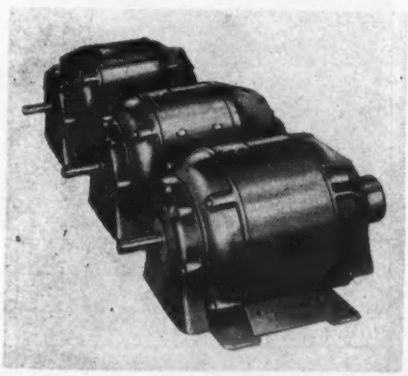
Electronic heaters; sizes 5 kw. (shown) and 15 kw.; convert 60-cycle power to high-frequency power at approximately 500,000 cycles. **General Electric Co.**, Schenectady, N. Y.

heaters is said to require minimum adjustment or tuning. Line voltage is stepped up by a power transformer and rectified to direct current. The direct current supplies the oscillator circuit, consisting of grid-controlled vacuum tubes shunted across a parallel resonant circuit. A timer in the oscillator permits the automatic timing of heating cycles.

•

Motors

In a new line motors are built within cylindrical shells of steel. In any one frame size the shell dimensions, head fit, bolt circle holes, shaft size and conduit box mountings are said to be identical for various motor types, *viz.*: Polyphase induction, capacitor start induction, repulsion induction, as well as standard d.c. motors and generators. Only the end head opposite the shaft extension varies from one type to another, resulting in a slight change in external appearance.



"Uni-Shell" motors (illustrated, polyphase, direct current, repulsion induction with covers added); frames 203 to 365, open and inclosed, horizontal and vertical, ball and sleeve bearings. **Robbins & Myers, Inc.**, Springfield, Ohio.

•

Welding Electrode

A.c. welding electrode; sizes 1/8, 5/32, 3/16 1/4 and 5/16 in. in diameter and 14 and 18 in. lengths; packed in 50-lb. containers. **Harnischfeger Corp.**, Milwaukee, Wis.

A new all-position electrode has been designed especially for use with a.c. transformer welding machines and is said to be suitable for all mild steel applications.

•

Wire Stripper

For stripping insulation from solid or stranded wires, stripper has hardened steel precision ground cutting blades. Different size cutting blades are interchangeable. Wire is held between two jaws and cutters. When operator presses on handle, insulation is cut and stripped from end of wire.

"Speedex" wire stripper; wire sizes No. 8 to No. 30. **Wood Specialty Manufacturing Co.**, Rockford, Ill.

•

Fluorescent Fixtures

"War Model" Day-Line fluorescent units; for two 40-watt, three 40-watt and two 100-watt lamps. **Day Brite Lighting, Inc.**, 5411 Bulwer Ave., St. Louis, Mo.

New fixtures are designed to comply with WPB steel limitation orders. Nonmetallic reflectors and channel covers are finished in baked enamel. Ballasts are mounted below the channel to provide better air circulation and lamp starters, which are located behind the sockets, are replaceable without disturbing lamps, it is claimed.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Welder

New welder gives operator correct voltage for the continuous range of current available, it is said, rather than using almost constant voltage at all current

"Ampac 200" a.c. welder; range of current 30 to 250 amps; handles rods 1/16 to 1/4 in. in size. **Allis-Chalmers Mfg. Co.**, Milwaukee, Wis.

tings. Unit includes new integrated reactor-transformer construction to provide high voltage for easy welding at low currents and reactor coils surrounding the variable air gap to assure active duty from every line of flux.

•

Furnace

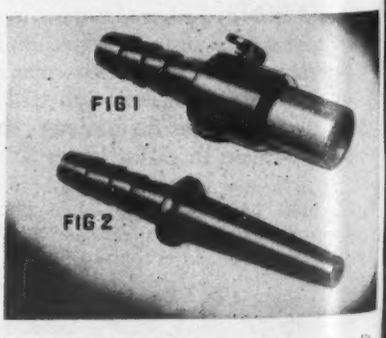
"MLR-4" bench type electric furnace; size 7½ in. wide by 5½ in. high by 14 in. deep; 1,850 deg. F continuously; 115 and 220 volts. **Harold E. Trent Co.**, Leverington Ave. & Wilde St., Manayunk, Philadelphia, Pa.

Tool room furnace for heat treating has outer casing of steel reinforced and lined with different layers of insulation and brick-lined welded steel door which can be used as a loading table. Furnace may be controlled manually or automatically, it is said. Heating elements are nickel chromium ribbon units.

•

Fire Equipment

Designed for use on standard size hoses of fire extinguishers and tanks pressure-operated by stirrup pump, new plastic nozzles are said to be corrosion-proof, nondenting and highly resistant to acids, alkalis and water content. Two-way nozzle can also be operated for a one-way stream by depressing a thumb-spring.



Plastic nozzles: Fig. 1, for two-way or split stream; Fig. 2, for one-way, straight stream. **American Molded Products Co.**, 1751 N. Honore St., Chicago, Ill.

—Like the HUBBARD AUTOGAP Lightning Arrester "Shoots Out" a follow-up arc

In Texas and other oil districts, when a well takes fire, a famous firm of oil field fire fighters is called in to extinguish the blaze. This is often accomplished by "shooting out" the blast after wreckage has been cleared and the fire confined to the smallest possible area, usually the jet emitted from the top of the casing. "Shooting out" consists of placing at the casing, a heavy charge of gelatinous nitroglycerine which, when exploded, destroys contact between the gases and the flames so that the continuous feed of combustible material to the point of ignition is interrupted. There is much more to the trick, but in principle, that is the process.

Hubbard *Autogap* Lightning Arresters employ exactly the same principle, but the "fire" in this case, is electrical, and the dissipating force is supplied automatically by the passage of the current through the arrester. When the current is forced around core "A" and through the minute clearances "B" to reach ground, the confinement and the contact with the fiber surfaces causes an explosion. The gases generated are exhausted simultaneously in opposite directions through vents. The follow-up arc is "shot out" just as the nitroglycerine explosion snuffs out a burning oil well.

For detailed data and diagrams write for an illustrated "Autogap" bulletin containing operating data, installation methods, results of tests and other pertinent information.

HUBBARD AND COMPANY

PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

"PROVED IN" LONG AGO FOR RURAL LINES

IN SERVICE SINCE 1936

Crapo Steel Conductor in rural primary distribution line. Location: Texas. Average span length, 600 feet.

Crapo STEEL CONDUCTOR

The operating efficiency of *Crapo* Steel Conductors was established long before the present emergency. Thousands of miles of these high-tensile, low-resistance steel conductors have been giving efficient, reliable and economical service on rural lines since 1936.

Crapo Steel Conductors afford an unique combination of electrical characteristics and physical properties never before attained in a ferrous conductor. They provide relatively low 60-cycle resistance, low magnetic permeability and low 60-cycle reactance. Their high-tensile strength permits the use of long-span, low-cost construction; saves man-hours and material; reduces maintenance problems.

Crapo Steel Conductors can be handled and "pulled in" with the same facility as any other conductor. For rural extensions authorized by Utilities Order U-1-c, specify *Crapo* HTC-130 in No. 6 B.W.G. Stranded (3-wire) — the type recommended for this purpose. Ask the representatives of the Graybar Electric Company Inc., Distributors, or contact the nearest Graybar office!

WRITE FOR NEW ENGINEERING MANUAL containing complete technical information on *Crapo* Steel Conductors, including electrical characteristics and performance, sag and tension data and applicable construction practices! Address:

INDIANA STEEL & WIRE COMPANY
MUNCIE, - - INDIANA

Crapo HTC-130 STEEL CONDUCTORS

TECHNICAL LITERATURE

"AMERICAN STANDARDS for Transformers, Regulators and Reactors" covers distribution, power, and regulating transformers, instrument transformers, constant-current transformers of the moving-coil type, step-voltage and induction-voltage regulators, current-limiting reactors and general purpose specialty transformers. It includes test code for transformers and guides for operation of transformers and regulators. Copy of the booklet comprising publications Nos. C57.1, 57.2 and 57.3 may be obtained from American Standards Association, 29 West 39th St., New York, N. Y.; price $1.25.

WIRING MANUAL—"Q-Floor Wiring" is a 48-page manual providing detailed data on layout and installation procedure, and containing illustrations and descriptions of the wiring material for under floor electrical distribution in cellular steel Q floors. Copy of the manual is available from Construction Materials Division, General Electric Co., Bridgeport, Conn.

TEST VOLTAGE—New American Standards covers methods for the measurement of test-voltages and wave shapes used in dielectric tests of electrical apparatus or insulating material. Copy of publication "Measurement of Test Voltage in Dielectric Tests," A.I.E.E. No. 4 or A.S.A. No. C68.1-1943 may be obtained from American Institute of Electrical Engineers, 33 West 39th St., New York, N. Y.; price 40 cents.

BRAZING—A 12-page booklet contains physical properties of a brazing alloy, Phos-Copper, discusses its use with gas, incandescent carbon, electric furnace and dip brazing methods, and gives hints for joint designs. Booklet B-3201, "Phos-Copper," may be secured from Dept. 7-N-20, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

ARC WELDING—Fifteen-section booklet has many charts, tables and illustrations helpful in choosing correct electrode, applying welding technique, estimating speeds and costs of welding jobs, and other data for increased production. The 42-page publication "Factors Affecting Increased Welding Production" is obtainable from The Lincoln Electric Co., Cleveland, Ohio.

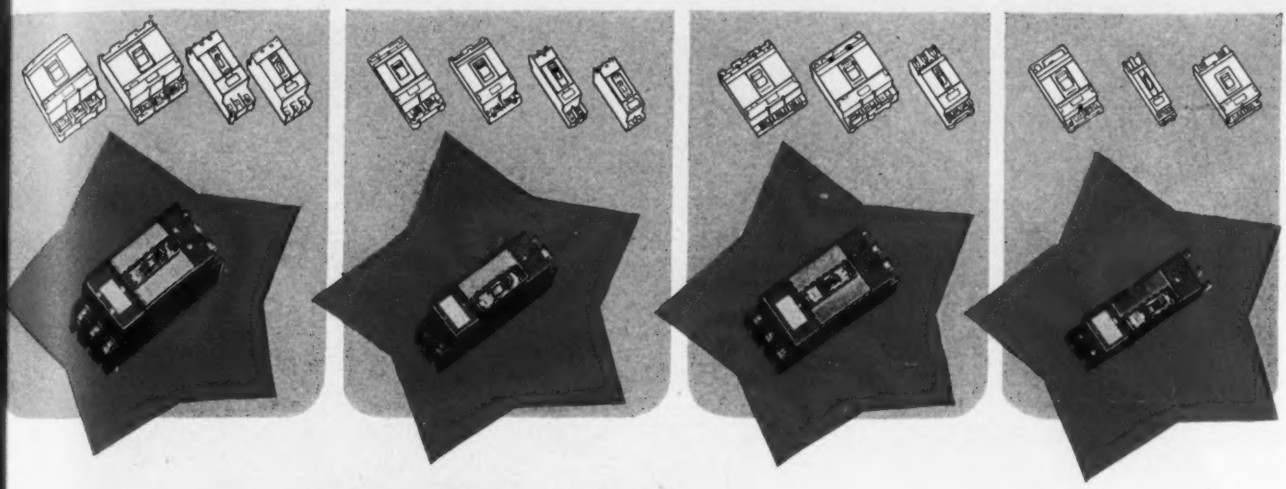
WIRING—A 16¾ x 18½-in. chart, "Concealed Knob and Tube Wiring and Open Cleat Wiring," has been revised to meet the latest requirements, according to the Code revisions of 1940. This chart illustrates how porcelain and other non-critical materials may be used. Other facts, and quantity prices may be had by writing to James Steel Mahan, 201 North Wells St., Chicago, Ill. Copies are 10 cents each in small quantities.

MOTORS—Definitions of terms and motor parts, speeds and duty classifications, motor types and standards are included in a pocket-sized handbook "American Electrical Standards for Fractional Horsepower Motors" obtainable from the Dumore Company, Racine, Wis.

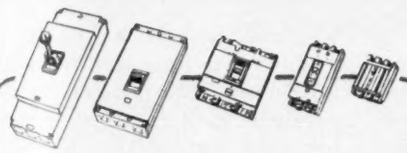
SILVER ALLOY BRAZING—Design of joints, shear depths, methods of heating, fluxing, form of alloy, cleaning and finishing of brazed joints are discussed in revised edition of Bulletin No. 12-A, "Low Temperature Brazing of Metals with Sil-Fos and Easy-Flo," obtainable from Handy & Harman, 82 Fulton St., New York, N. Y.

mobilized FOR WAR

4 breakers
TAKE THE PLACE OF 14



——TO SAVE 18% COPPER
——TO SAVE 38% STEEL
——TO CONSERVE SPACE
——TO IMPROVE CIRCUIT PROTECTION



Nofuze "De-ion" Breakers

—prevent *harmless* overloads from interrupting war production.

—protect circuits from *dangerous* overloads and "shorts."

—restore service *instantly* with just a flip of the switch.

As a voluntary war measure, Westinghouse has "mobilized" the Nofuze line of "De-ion" Breakers. For example, all ratings from 15 to 100 amperes have been made available in one compact frame size. Instead of 14 models, 4 now serve the same purpose. Pole spacing and terminal arrangements have been made standard for interchangeability. Space is saved—vital materials are conserved.

Today, the production of Nofuze Breakers is concentrated on war requirements. Our engineering facilities are serving all branches of the war effort on a broad consulting basis.

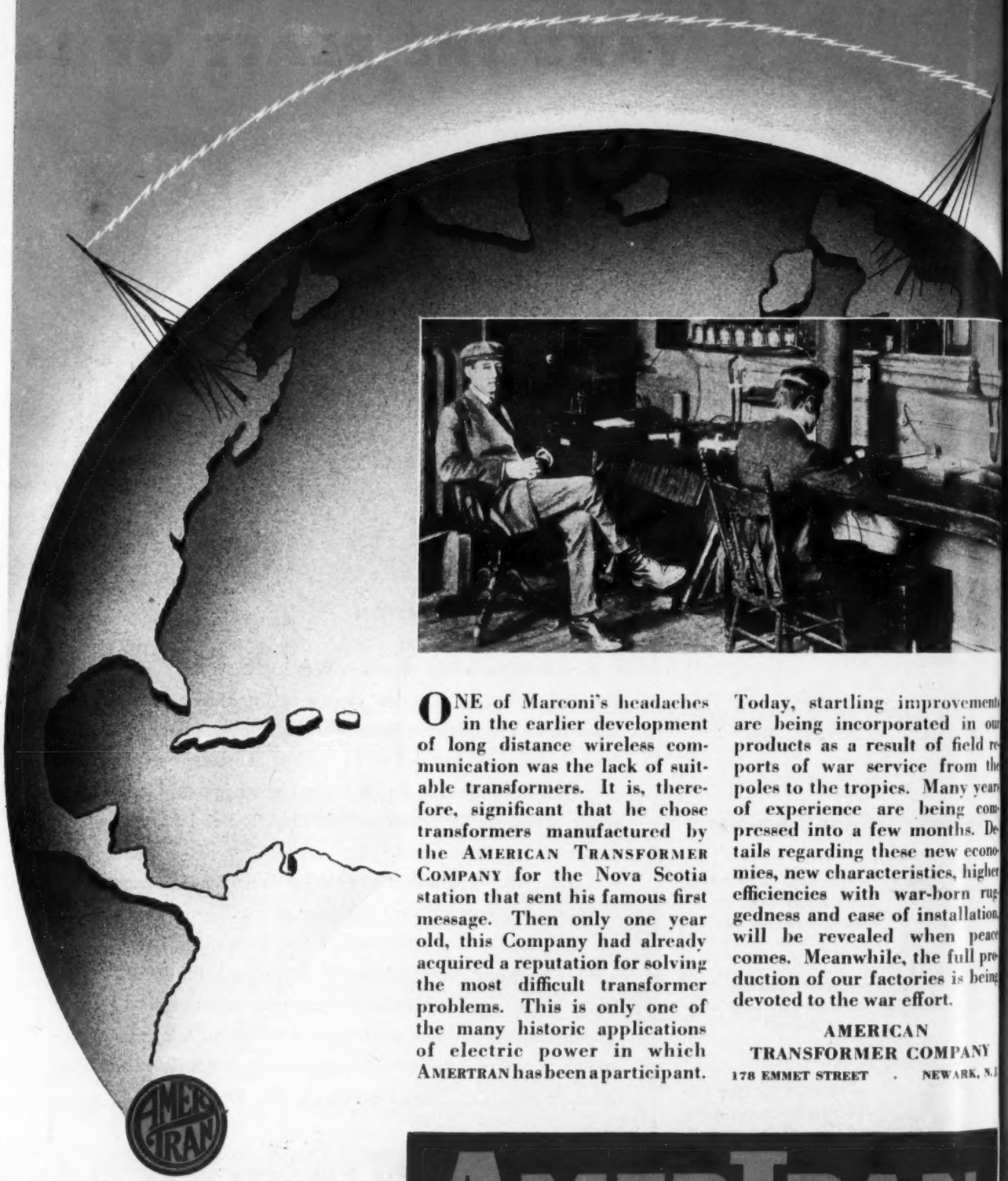
Result: many far-reaching developments are being made . . . overload protection of low-voltage circuits has been greatly improved. If you have a war circuit problem, ask your Westinghouse representative for engineering help. Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-60523

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

NOFUZE CIRCUIT PROTECTION

AMERTRAN helped Marconi
send his first message across the Atlantic!



ONE of Marconi's headaches in the earlier development of long distance wireless communication was the lack of suitable transformers. It is, therefore, significant that he chose transformers manufactured by the AMERICAN TRANSFORMER COMPANY for the Nova Scotia station that sent his famous first message. Then only one year old, this Company had already acquired a reputation for solving the most difficult transformer problems. This is only one of the many historic applications of electric power in which AMERTRAN has been a participant.

Today, startling improvements are being incorporated in our products as a result of field reports of war service from the poles to the tropics. Many years of experience are being compressed into a few months. Details regarding these new economies, new characteristics, higher efficiencies with war-born ruggedness and ease of installation will be revealed when peace comes. Meanwhile, the full production of our factories is being devoted to the war effort.

AMERICAN TRANSFORMER COMPANY
178 EMMET STREET . NEWARK, N.J.

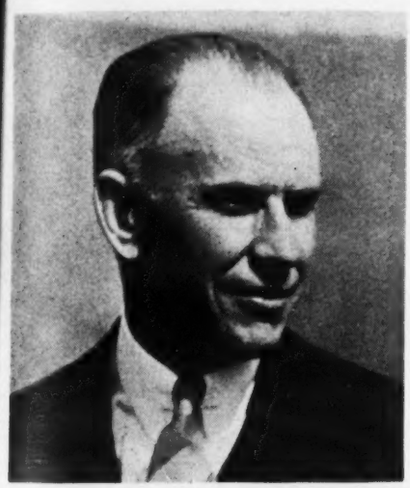
PIONEER MANUFACTURER OF
TRANSFORMERS, REACTORS AND RECTIFIERS
FOR ELECTRONICS AND POWER TRANSMISSION

AMERTRAN
MANUFACTURING SINCE 1901 AT NEWARK, N. J.

NEWS ABOUT PEOPLE

Allis-Chalmers Assigns New Duties to Edsall

In a consolidation of an important portion of its electrical engineering and manufacturing operations, Allis-Chalmers has made W. S. Edsall manager



of a newly combined switchgear and control division of the company's electrical department. Mr. Edsall goes to his new position in Milwaukee from the Allis-Chalmers Boston works, where he has been in charge as manager of the company's switchgear division.

He has an extensive background in the electrical field, particularly in the design and production of control equipment. After receiving a degree in electrical engineering from Montana State College in 1911, he was employed by Westinghouse, but later returned to continue his education. In 1916 he obtained a master's degree from the Montana institution and then the degree of bachelor of commercial science from New York University in the same year.

After World War I, Mr. Edsall, who had been in the Navy, continued his interest in marine engineering, conducting research for the Sperry Gyroscope Co. He was successively employed by the Condit Electrical Manufacturing Co. and the Brown-Boveri Corp., both of which were acquired by the Allis-Chalmers organization. Joining Allis-Chalmers, he was made sales manager of the circuit breaker division, and in 1938 was placed in charge of sales and engineering at the Boston works.

For many years Mr. Edsall has been active on technical committees of the National Electrical Manufacturers Association, the Edison Electric Institute and the American Institute of Electrical Engineers.

•

▶ FRANK BRIDGES of Monroe City was elected president of the Missouri Association of Municipal Utilities at the recent conference held in Kansas City.

▶ N. E. FUNK, vice-president in charge of engineering of the Philadelphia Electric Co., was awarded the honorary degree of doctor of engineering by Lehigh University at the recent commencement held at Bethlehem, Pa.

•

Covell Heads Purchasing Agents Utility Group

M. B. Covell, superintendent of supply service, Union Electric Co. of Missouri, has been elected to succeed F. A. Compton, Detroit Edison Co., as chairman of the Public Utility Group,

National Association of Purchasing Agents. J. R. Millikan, Dallas Power & Light Co., was chosen at the same time for the office of secretary-treasurer.

T. D. Johnson of Alabama Leaves Utility Field

T. D. Johnson, vice-president of Alabama Power Co. and head of its industrial development division, is resigning June 15 to take up new duties at Reading, Pa., with Vanity Fair Mills, Inc., where he will be connected with the executive staff of that company.

Commenting upon Mr. Johnson's

resignation, Thomas W. Martin, president, said: "Mr. Johnson's decision to leave us after 27 years of service, broken only by his service in World War I, came as a distinct shock and will represent a real loss not only to Alabama Power Co. but to Alabama as well. . . . Mr. Johnson will leave behind him a long record of faithful and efficient service and many friendships. . . . In the years that have passed many new industries have come to Alabama as a result of the efforts of the industrial development division working co-operatively with chambers of commerce and other civic bodies. In this work Mr. Johnson enjoyed the confidence of hundreds of industrial enterprises over the nation. It is our hope that his new duties will keep him in touch with developments in Alabama."

Mr. Johnson is a native of Ozark, Ala., and a graduate of the University of Alabama with the degree of B.S. in electrical engineering, class of 1916. Shortly thereafter he joined the power company and for many years actively engaged in its new industries work. He was elected a vice-president in 1941.

Mr. Johnson is being succeeded as head of the industrial development department by J. R. Lester, who for the past ten of his 24 years with Alabama Power Co. has been merchandise sales director and who for six years has been associated with the company's industrial development work. Mr. Lester is a graduate of Alabama Polytechnic Institute.

THE ONLY 3000-HOUR GUARANTEED FLUORESCENT LAMP

Rated 5000 to 6000 hours.

"LONG LIFE"*

EXCLUSIVE WITH ARTKRAFT HOT CATHODE FLUORESCENT LIGHTING

NO STARTER SWITCHES

Artkraft resonant starting eliminates this trouble-maker.

CONSTANT-TEMP HOT CATHODE

Corrugated mesh ribbon filament holds abundance of emissive compound. Control of primary voltages prevents rapid discharge.

CONSTANT VOLTAGE POWER PACK

Gives efficient operation at 85 to 135 volts. Can also be used on 220- and 440-volt systems, single or three-phase. Cannot short circuit the line.

plus these additional features

SIGNS * OF LONG LIFE

ARTKRAFT Hot Cathode Fluorescent Lighting Systems are now available through the manufacturing and distributing facilities of:

EDWIN F. GUTH COMPANY
F. W. WAKEFIELD BRASS CO.
FOSTORIA PRESSED STEEL CORP.

These companies will merchandise the Artkraft Systems under the name of Guth-Artkraft Fixtures, Wakefield - Artkraft Fixtures, and Fostoria-Artkraft Fixtures.

Artkraft licenses with other fixture manufacturers also will be announced soon. Those who have not as yet investigated the Artkraft license proposition are urged to do so immediately.

Artkraft's exclusive cathode design reduces blackening or darkening in the light column, resulting in a brighter, cleaner lamp.

100% POWER FACTOR at rated voltage.
98% or over within 85- to 135-volt range.

"Easy Mount" luminaire allows instant removal without tools, for cleaning non-ferrous reflector or lamps.

Stroboscopic (Flickering) Effect Reduced.

More light for the same current. Moderate first cost. Radically reduced maintenance cost. Lamp replacements are less frequent, starter replacements eliminated, ballast replacements unknown, man-hours saved by making these replacements unnecessary.

Field Tested Under Adverse Conditions for Over Five Years.

Write for Circular F 102.

WHOLESALERS: Write for our proposition.

FIXTURE MANUFACTURERS: Write for details on fixture manufacturing license.

ARTKRAFT

HOT CATHODE FLUORESCENT LIGHTING DIVISION

THE ARTKRAFT SIGN CO.

1115 E. Kibby St. ***Lima, Ohio, U. S. A.***

*Reg. U. S. Pat. Off.

LONG LIFE DEPENDABILITY

► GEORGE H. BUCHER, president of the Westinghouse Electric & Manufacturing Co., was awarded the honorary degree of electrical engineer by Stevens Institute of Technology at the recent commencement exercises held in Hoboken, N. J.

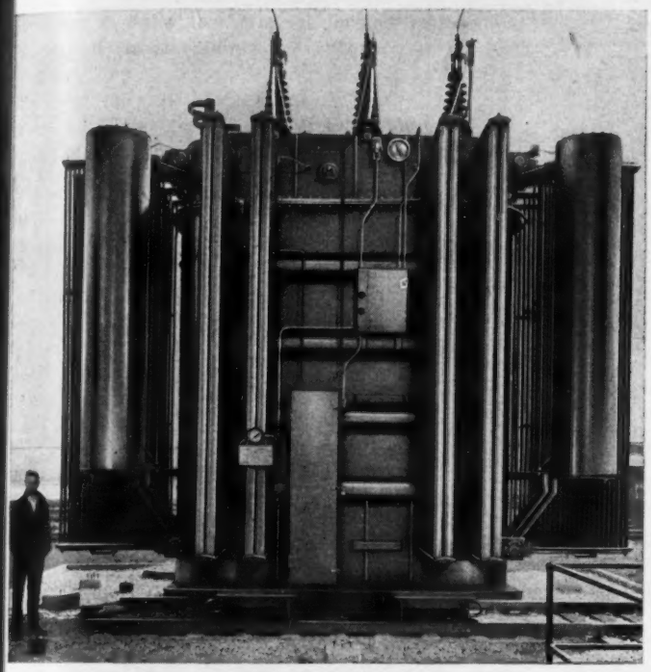
► CARL RIGGS, formerly WPA administrator for West Virginia, with headquarters at Huntington, has been appointed a member of the West Virginia Public Service Commission by Gov. M. M. Neely. Mr. Riggs succeeds C. E. NETHKEN, whose term expired on May 31.

► G. T. MORROW, vice-president of Curtis Lighting, Inc., in charge of sales since 1940, has assumed the duties formerly performed by M. C. Wilt, executive vice-president. Mr. Wilt has been commissioned a Lieutenant-Commander in the Supply Corps, U.S.N.R., and will be on leave of absence from Curtis for the duration. Mr. Morrow, who will retain his responsibilities as vice-president in charge of sales, has assumed the title of acting general manager. He has been with the Curtis organization since 1922, first as district representative in Pittsburgh, later as assistant sales manager and general sales manager. He is a graduate of the University of Pittsburgh.

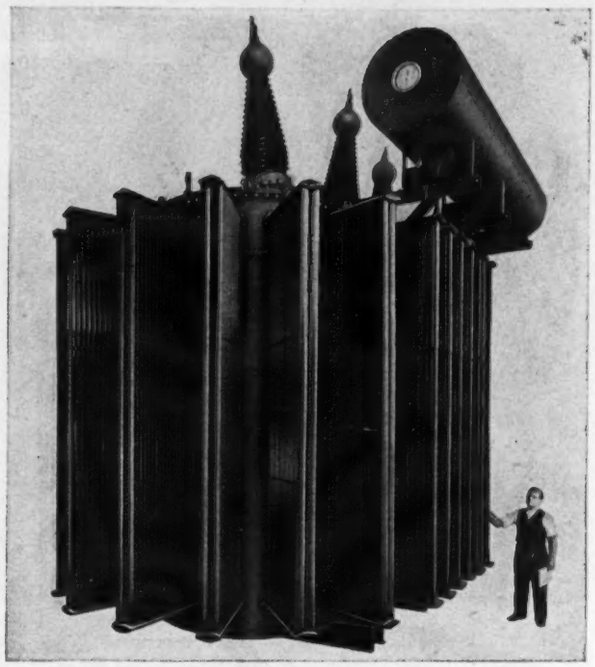
► LEWIS H. BROWN, president of Johns-Manville Corp., was made the recipient of the honorary degree of LL.D. at Brown University's commencement exercises held on June 2. The citation read: "Having worked your own way in the world, you early gained and steadily manifest that profound respect for labor and that sincere regard for the personal dignity of the workman which must underlie effective industrial relations. Coming to great responsibility at a moment of economic collapse, you met the crisis with resourcefulness and daring emphasis upon new developments, setting the pattern for the reorientation of industrial processes. Undaunted by problems, undismayed by adversity, unyielding in fidelity to principle, you have made free enterprise a true public service, and you have discharged the duties of citizenship with the same active loyalty with which you fulfilled military obligations."

► E. J. FOWLER, statistician for Commonwealth Edison Co., retired from active service June 1, after 47 years with the company. He will be succeeded by his assistant, GEORGE L. JORGENSEN. Starting his utility career in 1896 as a substation operator, Mr. Fowler transferred the following year to the general superintendent's office and was assigned to statistical work. The scope of the activities under his supervision expanded rapidly, resulting

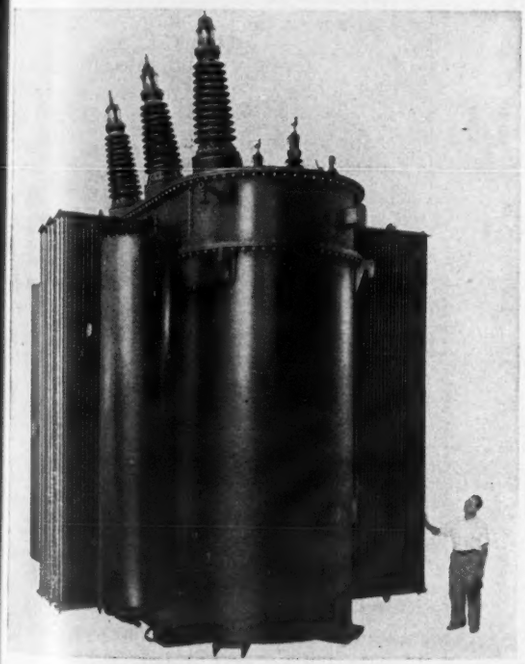
MOLONEY TRANSFORMERS



25,000 Kva, 69,000 Y to 13,800 volt three-phase transformer equipped with inert gas protection.



23,500 Kva, three-phase power transformer, rated 115,000 volts to 13,800 volts.



10,000 Kva, 3-winding, 3-phase power transformer, primary 110,000 volts, secondary 66,000 volts, tertiary 7200 volts.

QUICK SHIPMENT on MOLONEY Power Transformers

WHERE quick shipment of Power Transformers is vitally important, Moloney can offer unequalled service.

Large stocks of parts and materials make this possible.

Moloney excellence of quality is not sacrificed even though quick shipment is made. Full processing, thorough continuous inspection and complete testing are given every transformer.

The Moloney engineering staff is at your disposal to help you quickly solve any of your transformer problems. *For prompt quotation and quick shipment, send your inquiries to*

MOLONEY ELECTRIC COMPANY • ST. LOUIS, U. S. A.

TRANSFORMERS EXCLUSIVELY SINCE 1896

Federal Rolarc SAFETY FACTORS

INCREASE PRODUCTION

When a switch fails machines stop—vital war production slows down. And one of the reasons for switch failure is uncontrolled arcing. That's why the Federal 575 Volt Rolarc Safety Switch* is built with special safety features to control and reduce arcing to an *absolute minimum*—and so to increase production by eliminating delays and accidents caused by switch failure.

Two parallel cylindrical rollers fabricated from high arc-resistant material form an insulating barrier to "dam up" and snuff the arc. This gives the Rolarc many added advantages that increase switch safety and service through perfect control of arcing.

Follow the leaders—for extra service and safety switch to Federal.

*100-600 Amperes only.

For Complete Rolarc Data

write for Bulletin 42-12. Contains all the essential facts on the Federal 575 Volt Rolarc Safety Switch.

FEDERAL ELECTRIC PRODUCTS COMPANY

54 PARIS STREET NEWARK, N. J.

PANELBOARDS • SWITCHBOARDS • SAFETY SWITCHES • CIRCUIT BREAKERS

in the early formation of a statistical department, which he has headed from its inception. Mr. Fowler has been chairman or a member of many committees in national electrical associations. As a major in the Quartermaster Corps during World War I he had charge of statistical work in the office of Quartermaster-General Robert E. Wood. Mr. Jorgensen, who succeeds Mr. Fowler, entered the company's employ in 1909 as a clerk in the statistical department, and became head statistical clerk in 1915. He has been assistant statistician since 1931.

▶ JAMES M. CONWAY, formerly vice-president in charge of purchases for Bishop Gutta Percha Co., manufacturer of insulated wire and cable, has been elected president of the company to succeed the late Henry D. Reed. Mr. Conway, who began his career with the company 25 years ago, is a member of the board of the Purchasing Agents Association of New York.

▶ HARRY W. DALBY, formerly senior engineer, War Department, Corps of Engineers, in charge of electrical section, military projects division, Denison, Tex., is now chief electrical engineer, Consolidated Vultee Aircraft Corp., Allentown division. Previous to being senior engineer with the War Department at Denison, Tex., Mr. Dalby was electrical engineer for Consolidated Builders, Inc., Grand Coulee Dam, Mason City, Wash.

▶ N. E. CANNADY, state electrical engineer and electrical inspector of North Carolina, has been appointed state civilian defense co-ordinator for electrical services for the state of North Carolina.

▶ R. H. KNIPPING has become associated with the Power Specialty Co. of Houston, Tex. He will shortly take over the San Antonio, Austin, Corpus Christi territory, which he covered some years ago. Mr. Knipping has had wide experience in the application, operation and servicing of the lines the company handles.

▶ HENRY DRESSEL has been appointed supervisor of electronic components engineering for the Stackpole Carbon Co., St. Marys, Pa. Mr. Dressel has been a member of the Stackpole engineering staff for several years. Prior to that he was associated with the Oak Manufacturing Co. in Chicago.

▶ ADIN L. DAVIS has been appointed advertising manager of the Worthington Pump & Machinery Corp. For the past 2½ years Mr. Davis has been serving the corporation in the capacity of sales promotion manager for the construction equipment division, located at the Holyoke, Mass., works. In his new

GENERAL PURPOSE STEELS

Steel Products, Tools, Machinery and Equipment

A call to us may solve your problem. Many such calls have kept vital war production from being stopped for lack of some piece of steel—or some piece of machinery or equipment. If we have what you want, it can be yours *in a hurry*—subject, of course, to priority restrictions. If we don't have it, we'll do everything we can to help you find a source of supply. Try us—note addresses, phone and teletype numbers at right.

NATIONAL EMERGENCY ALLOY STEELS

These new steels have made it possible to meet the critical conditions imposed by the shortages of strategic alloys. They have given satisfactory results—in fact, have sometimes out-performed steels previously used.

We welcome your inquiries. We'll gladly assist you in determining the grades best suited to your needs. Phone, wire or write our nearest warehouse.

AIRPLANE STEELS

Our Chicago Warehouse has been designated by the War Production Board as a warehouse to distribute the aircraft materials listed below. They are for use in airplanes and available at our Chicago Warehouse only.

WD-X-4130 SHEETS. Open Hearth, Normalized, Pickled and Oiled to Spec. AN-QQ-S-685, Condition N. All gauges .016 to .50, sheets 18 x 72".

NE-8630 SHEETS. Open Hearth, Normalized, Pickled and Oiled to Spec. AN-S-12, Condition N.

STAINLESS STEEL BARS.....Spec. AN-QQ-S-771.

STAINLESS SHEETS .....Spec. AN-QQ-S-772. Spec. AN-QQ-S-757.

WRITE, PHONE OR WIRE, if you are eligible for these Airplane Steels, to United States Steel Supply Company, P.O. Box MM, Chicago, Ill. Telephone BRUnswick 2000 — Teletype CG. 605.

UNITED STATES STEEL SUPPLY COMPANY

(formerly Scully Steel Products Company)

CHICAGO,	1319 Wabansia Ave., P. O. Box MM	**BRUnswick 2000** *Teletype CG. 605*
BALTIMORE,	Bush & Wicomico Sts.,	**GILmore 3100** *Teletype BA. 183*
BOSTON,	176 Lincoln St., Allston, P. O. Box 42	**STAdium 9400** *Teletype BRTN. 10*
CLEVELAND,	1394 E. 39th St.,	**HEnderson 5750** *Teletype CV. 153*
NEWARK, N.J.,	Foot of Bessemer St., P. O. Box 479 *Teletype NK. 74*	**BIgelow 3-5920** **REctor 2-6560** **BErgen 3-1614**
PITTSBURGH,	1281 Reedsdale St., N.S.,	**CEdar 7780** *Teletype PG. 475*
ST. LOUIS,	21st & Gratiot Sts.,	**MAin 5235** *Teletype SL. 384*
TWIN CITY,	2545 University Ave. St. Paul, Minn.	**NEstor 2821** *Teletype STP. 154*

UNITED STATES STEEL SUPPLY COMPANY
USS
STEELS
SERVICE

UNITED STATES STEEL

RE-LIGHTING
the new manpower / production *requirement*

HERE'S ONE ANSWER
to this problem...

This new folder tells the whole story. Send for it!

Because most plants operating today were designed for peacetime, *daylight* working schedules, *their lighting equipment is inadequate for night work!*

The folder illustrated gives one answer to industry's problem of *re-lighting*. Silv-A-King's new fluorescent reflectors of non-critical, metal-saving Silv-A-Tex are durable, efficient, inexpensive, and available for prompt delivery. For complete descriptions and specifications of Silv-A-King "Victory" units, write for a copy of "Catalog 43-V" today!

UL SILV-A-KING RLM

SILV-A-KING
MAKES *Light* WORK FOR YOU

BRIGHT LIGHT REFLECTOR COMPANY, INC.
1031 Metropolitan Avenue, Brooklyn, N. Y.

BROILKING AFTER THE WAR, MORE THAN EVER *America's Finest Electric Table Broiler*
INTERNATIONAL APPLIANCE CORPORATION
1027 Metropolitan Avenue, Brooklyn, N. Y.

assignment he will have complete charge of advertising, sales promotion and publicity activities for the entire corporation and will make his headquarters at the main office at Harrison, N. J. FREDERICK A. POPE, whom Mr. Davis succeeds, has been apopinted manager of the publication and personnel department.

► JAMES TATE has joined the Dumore Co., Racine, Wis., in the capacity of director of industrial marketing and research. Mr. Tate will be responsible for planning the company's marketing and manufacturing program in the postwar era. He brings to his new position wide experience obtained in industrial management and production positions.

► IDA L. TRAUGHBER has resigned as treasurer of the A. B. Chance Co., Centralia, Mo., after 33 years of service. Miss Traughber's retirement ended an active career which started in 1910, only three years after A. B. Chance was organized. She will leave her home in Centralia to live in California.

► L. W. LONG has been appointed by the Allis-Chalmers Manufacturing Co. as sales engineer in charge of mixed apparatus sales. The appointment was made by the company in order to coordinate sales involving the apparatus of more than one division of the electrical department. Mr. Long joined Allis-Chalmers in 1925 and until early last month served as sales engineer in the Pittsburgh office. He is an electrical engineering graduate from Penn State University and is a member of the American Institute of Electrical Engineers.

► C. J. MILROTH has succeeded GEORGE SOWASH as assistant advertising manager of the Copperweld Steel Co., Glassport, Pa. Mr. Sowash has been granted a leave of absence to enter the army. Mr. Milroth spent approximately two years in the mill production office prior to entering the advertising department.

► GEORGE D. AUSTIN has been appointed assistant to the production manager of the Pittsfield, Mass., works of General Electric, succeeding J. B. DUNN, who has been transferred to the Lynn Works. Mr. Austin entered the employ of the Pittsfield Works in 1922 as a press hand in the porcelain department, later being assigned to time studies. In 1936 he was made assistant and in 1940 supervisor of the power transformer production department.

► FREDERICK S. ROWE, who joined the Westinghouse Lamp Division, Bloomfield, N. J., at the age of 16, as a production clerk, has been appointed manager of electronic tube production and stocks. WILLIAM J. KNOCHEL has been

LONG LASTING TROUBLE-FREE DEAD-ENDS for Light and Power Distribution Lines

•

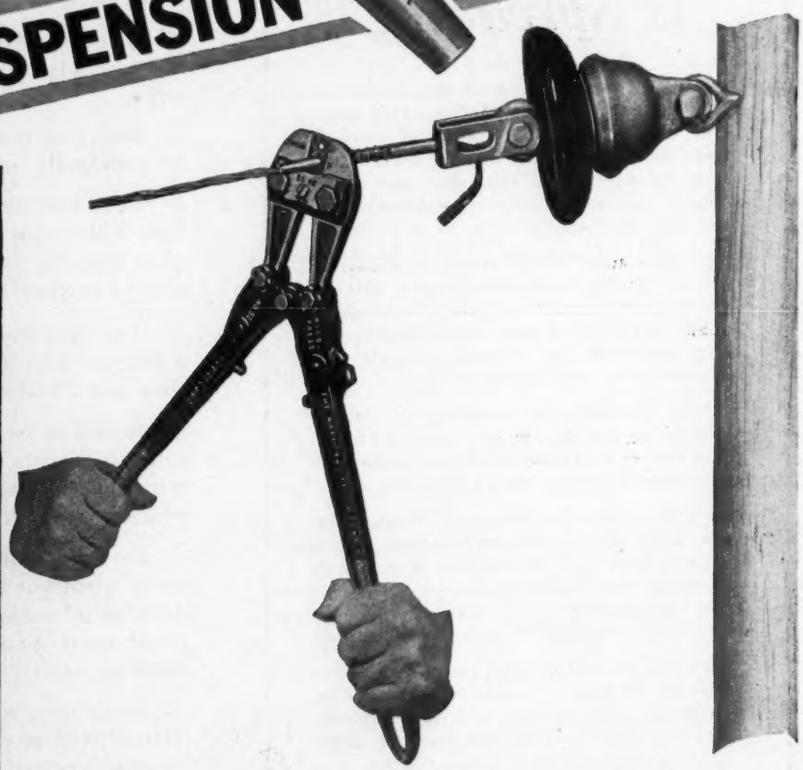
Nicopress SUSPENSION DEAD-ENDS

Nicopress Suspension Dead-Ends are by far the most economical and satisfactory way of making open wire terminations. Designed for use with disc insulators, and assembled all in one unit for convenience in handling, they are speedily installed with the same tool used for making line joints.

In making the Nicopress Suspension Dead-End the conductor goes straight through without bending or distortion. This assures exceptional strength and tightness of terminations and increases to a remarkable degree their ability to resist vibration.

As provision is made for a tail of any desired length jumper connections or tap-offs can be easily installed.

ORDER FROM YOUR JOBBER



THE NATIONAL TELEPHONE SUPPLY COMPANY

Manufacturer of Specialties for Power and Communication Lines

5100 SUPERIOR AVENUE • • CLEVELAND, OHIO

Canadian Mfr.—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

Export Distributor—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

This
NEWSPAPER
advertisement was published in Washington, New York and Chicago by McGraw-Hill, to make friends for business.

Labor needs SEED MONEY *too*

The Idea is Spreading

Some weeks ago, we began offering mats of the "Seed Money" series of McGraw-Hill newspaper advertisements to industrial managements, for use over their own company signatures. As a result of this offer, our "Seed Money" messages now are being carried in more than 25 newspapers.

An adaptation of the theme is appearing in 1,424 weekly newspapers and 2 national farm journals. In addition, many thousands of booklet reprints of each advertisement are being purchased by various companies for distribution to their employees.

Other companies are reprinting or quoting these messages in their house organs, and newspaper editors are beginning to give recognition to the "Seed Money" theme editorially.

We plan to continue the series in Washington, New York and Chicago newspapers, and in our own group of publications. It will help accomplish this important educational job if more manufacturers will sponsor this, or a comparable campaign in their own localities.

We will be glad to send you a mat of this particular advertisement in 1,620-line size for newspaper reproduction, with the signature space left blank for your own company name.

James H. McGraw, Jr.
President
McGraw-Hill Publishing Company, Inc.

IN many an advertisement, we have thumped the tub about the need for Seed Money, to give *industry* a chance to provide jobs after the war.

Labor is an important part of industry, and *labor* needs Seed Money, too.

After all, the problems of an individual worker and the man who runs the plant he works in are very much alike.

Both face the problem of getting out war production at constantly increasing speeds.

► Both face the problem of what to do about the men who will return when the war is over . . . the manager must plan for hundreds of such men, the worker for a son, or brother, as well as himself.

The manager runs a giant machine, which we call a factory. The worker runs a single machine. Together they are INDUSTRY.

In this sense, every worker is in business for himself. He "rents" the use of a machine, and pays for it with his time and skill. His wages, above his actual cost of living, represent his profit.

In war, each worker is asked to get more and more work out of his machine. Every time the worker does more work in less time, he creates a profit. That profit must go somewhere, and that's where tangled thinking starts.

Some people say "Don't let labor have the profit. That will raise prices and cause inflation." Others say "Labor created the profit, they should have it all." Still others say "Profit from war is unthinkable. It should be destroyed by taxes."

Don't you see that none of these things is true. High

[FREE MATS: If you would like to publish this message over your own company name, or distribute it in handy booklet form, write or wire: Research Dept., McGraw-Hill Publishing Company, Inc., 330 West 42nd St., New York.]

Labor needs SEED MONEY too (cont'd)

wages cannot raise prices, as long as they are the result of doing more work in less time. Henry Ford proved that a generation ago.

What Creates Inflation?

It is spending, not earning, that creates inflation! War Bonds can be made to control spending, and War Bonds ARE Seed Money. They are the money we put aside to take care of us in the days when our machines will need some other purchaser than the Army and Navy.

The money for War Bonds comes from the profit that is available to labor, management and owners, when machines are run efficiently.

That is the great advantage of capitalism. While we are running our machines at top speed in the titanic waste of war, these same machines are piling up profits that can be used to rebuild our country and our lives when the war is over.

► Part of this profit belongs to labor, part belongs to owners and managers for developing still better machines, part belongs to the customer in the form of lower prices (in war, the customer is Uncle Sam). If that sounds like our Fighting Men get no benefits from these profits, remember that the faster our machines run, the shorter the war will be. If you were a soldier, what kind of country would you like to come back to? One that was flat on its economic back, or one where people were in shape to work and offer you a chance to earn a living?

We believe competition between workers, as well as between industries will produce the goods to win this war faster than any other method man can devise.

The best method ever developed to encourage the competitive spirit is the automatic reward system which we call capitalism.

It's time for folks to understand what makes capitalism tick. We can get more war production, and slip back into high gear faster after the war, if we look at industry the way it is and make our laws and regulations on the basis of the way it works best.

► Here is the formula that is most successful in putting human nature to work on *any* production job, either in war or in peace:

1. Constantly improve the equipment available for the workers.
2. Use the lowered costs thus produced to
   (a) lower prices to consumers.
   (b) raise wages.
   (c) provide incentives for invention, investment, and individual enterprise.
   (d) lay aside "Seed Money" that can be used to start over again at item 1.

"Seed Money" produces better living

► America has always been an inventor nation. Throughout the years, most of the profits of business have been used to buy inventions . . . better machines, more efficient factories, research for better products. We call profit that is "plowed back" into business "Seed Money." Through Seed Money, products are constantly improved, making possible lower prices and higher wages.

Did you know that this process of putting aside Seed Money has been almost entirely eliminated by our tax law?

Congress, in shutting the door on wartime profiteers, wrote the Excess Profits Law in such a manner that it also takes away most of the Seed Money of business.

Industry must have Seed Money to continue the work of making better products available at lower costs, to create more jobs and pay higher *real* wages. The Excess Profits Law must be changed if we are to provide Seed Money for making post-war jobs. If you think so, too, ask your Congressman to review this law and all laws—with this principle in mind:

"Industrial Progress is the Source of all Good Living."

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

22 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

This advertisement is available in handy booklet form. (Less than 100 copies free. Larger quantities, $1.50 per 100; $10.00 per 1000.)

McGRAW-HILL

PUBLISHING COMPANY, INC. . . . BOOK COMPANY, INC.

330 WEST 42ND STREET, NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

American Machinist • Aviation • Bus Transportation • Business Week • Coal Age • Chemical & Metallurgical Engineering • Construction Methods • Electrical Contracting • Electrical Merchandising • Electrical West • Electrical World • Electronics • Engineering & Mining Journal • E. & M. J. Metal and Mineral Markets Engineering News-Record • Factory Management & Maintenance • Food Industries • Mill Supplies • Power • Product Engineering • Textile World • Wholesaler's Salesman • Business Publishers International Corporation, an affiliate, publishers of Business and Technical Magazines for Latin America, and Overseas Circulation.

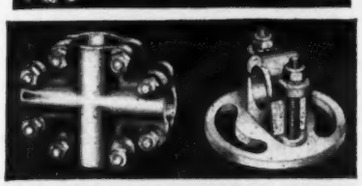
"When you need ANY Power Connector—

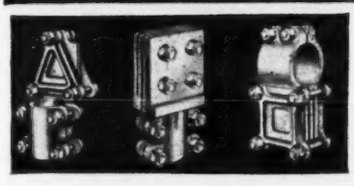
—see the COMPLETE line"

Probably the exact Power Connector you want is shown in the Penn-Union Catalog.

You will find Tee, Stud and End Connectors, Bus Supports, Terminals, Elbow and Cross Connectors, Couplers and Reducers—

—each in a wide range of sizes, up to the largest. Here are a few of the many types:





Also the most complete line of Cable Taps, Straight and Parallel Connectors, Lugs, Grounding Clamps — every good type.

Leading utilities, industrials, electrical manufacturers and contractors have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.* Write for Catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

named assistant superintendent of electronics manufacturing. In his new position Mr. Rowe will be responsible for scheduling and co-ordinating the production of electronic tubes in all plants of the lamp division, in addition to handling contacts between the sales and manufacturing departments. Mr. Knochel, who will be responsible for co-ordinating the manufacture of electronic tubes, joined Westinghouse in 1929 as a draftsman. Since 1933 he has been associated with radio tube engineering and manufacturing activities and in 1942 was appointed engineer and production supervisor of electronic tubes. Mr. Knochel is a member of the American Institute of Electrical Engineers, the Institute of Radio Engineers and the American Welding Society.

► DR. J. J. PYLE, formerly group leader in charge of research and chemical development, has been appointed chemist in charge of the plastics laboratories of the Pittsfield, Mass., Works of General Electric. He succeeds Dr. G. F. D'ALELIO, resigned. Mr. Pyle is a native of Calgary, Alta., and was educated at the University of British Columbia, receiving his doctorate at McGill. He went to Pittsfield in 1939 from the company's Lynn Works, where he was production and development chemist in the plastics laminating division. James W. Underwood of the Pittsfield Works laboratory has been appointed administrative assistant to Dr. Pyle.

► H. R. BRUMBAUM, sales executive of Landers, Frary & Clark, New Britain, Conn., is resuming his connections with that organization after a year's leave of absence, during which time he has been associated with the Office of Price Administration, Washington, D. C. Prior to his activities in the OPA he was sales manager of the department store division of Landers, Frary & Clark, supervising sale of merchandise to department stores. A. E. HANBURY has also returned to the company for the duration of the war in the capacity of general superintendent, assisting H. C. Edgerton, works manager of the Universal plants. For a number of years until 1936, when he left to conduct a real estate business of his own, Mr. Hanbury was superintendent of the washing machine division of Landers, Frary & Clark. H. K. FORBES has been elected assistant treasurer of the company. Mr. Forbes entered the employ of the corporation in 1913 and has been connected with the accounting department.

► GILBERT F. HAIN, for the past 17 years manager of the Seattle, Wash., office of the lamp division of the Westinghouse Electric & Manufacturing Co., has been appointed lamp division manager for the Los Angeles area. Mr. Hain succeeds BERT R. DELERAY, who has resigned to become manager of the San Francisco branch of the Tri-State Supply Corp. Mr. Hain joined the electric appliance division of Westinghouse in 1924 and served for two years at the Spokane, Wash., office. In 1928 he was transferred to the Seattle office of the lamp division. He served there until his recent transfer to Los Angeles.

► J. Y. DAHLSTRAND has been elected vice-president of the Universal Gear Corp., Indianapolis. Mr. Dahlstrand, who for the past five years has been chief engineer and director of sales, was previously connected in engineering capacities with the Murray Iron Works Co., Allis-Chalmers Manufacturing Co. and Westinghouse Electric & Manufacturing Co. CHARLES H. AMY has been elected treasurer. A certified public accountant, Mr. Amy formerly conducted his own practice and was associated with industrial and financial organizations.

OBITUARY

► MOREY F. ORRELL, for the past 32 years superintendent of fire alarm and police telegraph systems at Worcester, Mass., died at his home in that city on May 22. He was a native of Manchester, N. H.

► S. STANLEY KENT, chief engineer of the Locks & Canals Corp., Lowell, Mass., and at one time connected with the hydraulic division of the Stone & Webster Engineering Corp., Boston, died suddenly at Lowell on May 16. He was first vice-president of the Boston Society of Civil Engineers and had been with the Lowell corporation since 1919, succeeding Arthur T. Safford on his retirement a few years ago.

► CYRUS C. YAWKEY, 80, prominent Wausau, Wis., industrialist and financier, died suddenly May 18, in that city. Mr. Yawkey was an organizer of the Wausau Street Railway Co. in 1906, and later when the company became the Wisconsin Valley Electric Co. he was elected president. He served in this capacity until 1927, when the firm was sold to the Byllesby interests. The company is now part of the Wisconsin Public Service Corp. In 1913 Mr. Yawkey helped organize the Minnesota Utilities Co., which he served as vice-president and later as president until its sale to the American Power & Light Co. in 1922.

► H. CLAYTON PEARSON, 59, for the past five years assistant sales manager of the American Steel & Wire Co., New England area, died suddenly at his home in West Newton, Mass., on May

23. He was born in Springfield, Mass., and in earlier years was employed in the order department of the company at Worcester, New York and in 1921 at Boston, where he was later appointed to the sales staff. Mr. Pearson was active in the American Society for Metals and was well known in utility circles in the northeast.

▶ FRED P. HARRIS, manager of the purchasing division of General Electric lamp department with headquarters at Nela Park, Cleveland, died on May 23 at his home in Mentor Headlands, Ohio. He was 66 years of age. Mr. Harris, who was with General Electric's lighting division since 1904, was widely known in the electrical industry and among purchasing agents throughout the country.

▶ FRED W. FRENCH, vice-president of the American Brass Co. and founder of the company's small tube branch, died on May 31 in Waterbury, Conn., in his eighty-first year. He had been ill two months. An American Brass Co. executive since 1929, Mr. French had been active in overseeing vitally essential war production.

▶ JAMES H. MINER, assistant chief engineer of the Grand Coulee Dam in the state of Washington, died on May 31 at his home near the project, after an illness of nine months. He was 65 years old. Mr. Miner, who had been with the U. S. Bureau of Reclamation since 1934, was graduated from Cornell University in 1902. He formerly was employed as a hydraulic and civil engineer with the old Dwight P. Robinson Co., New York engineers. Subsequently he was identified with United Engineers & Constructors, Philadelphia. Before affiliating himself with the Bureau of Reclamation he served as resident engineer on construction of distribution system and central heating plant for public buildings in Washington, D. C.

▶ PETER C. GILL, electrical transmission and distribution superintendent of the B. C. Electric Railway Co., Vancouver, B. C., died recently, after long service with the company. Born in Prescott, Ont., Mr. Gill was graduated from McGill University in electrical engineering. He joined the B. C. Electric in 1910 as assistant in the electrical department at the Vancouver office. In 1914 he became distribution engineer, receiving his appointment as superintendent in charge of construction and maintenance of all overhead and underground power circuits throughout the company's lower mainland system in 1929, the position he held at the time of his death. Mr. Gill was a member of the American Institute of Electrical Engineers.

To Help Workmen

GET THE MOST FROM TOOLS

IT takes tools—lots of them—to win a mechanized war. Every pair of pliers—every wrench—every hand tool that is broken on the home front is a break for Hitler.

To aid experienced electricians and mechanics to get the most out of tools—to help train green hands, too—Mathias Klein & Sons have prepared a pocket-size guide containing valuable information on the care of tools and suggestions for their safe use. This is a contribution we are making to aid fighters on our industrial front in securing the long life and satisfactory service that is built into the quality tools they use. Mail the coupon below for your copy.

ASK YOUR SUPPLIER

Foreign Distributors:
International Standard Electric Corporation, New York

Mathias Klein & Sons
3200 Belmont Avenue, Chicago, Illinois
Gentlemen: Please send me without charge a copy of the booklet *"Long Life to Tools."*

Name.....

Address.....

City.....*State*.....

KLEIN TOOLS

Mathias KLEIN & Sons
Established 1857
Chicago, Ill., U.S.A.
3200 BELMONT AVENUE, CHICAGO

MANUFACTURING-MARKETS

Robertson Stresses the Home Front

In a letter recently mailed to all Westinghouse employees, A. W. Robertson, chairman of the board, emphasized that "greater effort on the part of each of us is required, both in the home and on the production lines, in order to supply the increasingly greater demands of our men at the front."

"Let each one of us resolve that he will do his work so well that no Westinghouse product will ever fail on account of poor workmanship," Mr. Robertson said. "Let it never be said that an American boy died because Westinghouse apparatus failed him. In a very real sense the lives of our neighbors and our sons are in our hands. . . . This is our battle front and here we must make victory sure."

•

Post-War Plan Prepared

Sylvania Electric Products, Inc., has detailed plans for resumption of its normal activities in the post-war period, Walter E. Poor, president, has announced. Mr. Poor predicted a transition period for industry generally, during which war output will be replaced slowly by civilian goods, and expressed the opinion that at the end of such transition period sales of regular radio tubes and lighting products will be in larger volume than before the war.

•

Outline Plan for Radio Electronics Future

Post-war engineering planning for the radio and electronic industry and services is offered in a proposal by the board of directors of the Institute of Radio Engineers. This proposal aims to put into force suggestions made to the institute by James L. Fly, chairman, and Commander T.A.M. Craven, both of the Federal Communications Commission, by creating a radio technical planning association to be sponsored by interested engineering and scientific societies, industrial and broadcasting associations, and the government.

The objectives are to study all technical problems of such radio branches as broadcasting, television, facsimile and general communication, and to recommend methods for introducing new radio developments.

INDOOR CLIMATE INSTITUTE—Organization activities of the Indoor Climate Institute are being directed by members of the accompanying steering committee—(Front row l. to r.) P. B. Zimmerman, Airtemp Division, Chrysler Corp., chairman; C. T. Burg, Iron Fireman Mfg. Co.; W. J. Grover, Surface Combustion Corp.; J. M. McClintock, Illinois Iron & Bolt Co.; A. T. Atwell, Quaker Mfg. Corp. (Back row l. to r.) C. E. Lewis, Delco Appliance Corp.; L. N. Hunter, National Radiator Co.; C. D. Lyford, Minneapolis-Honeywell; J. R. Scott, Mueller Furnace Corp.; W. H. Knowlton, secretary.

Indoor Climate Institute Planned

Plans for the formation of an industry-wide co-operative educational program, known as the "Indoor Climate Institute," which will acquaint the American public with the best equipment and methods for producing indoor comfort in the post-war homes of tomorrow, were disclosed recently by Paul B. Zimmerman, vice-president Airtemp Division, Chrysler Corp., speaking before the National Warm Air Heating and Air Conditioning Association. The Indoor Climate Institute program will be educational and promotional in nature and will not supersede any of the operating functions of the various trade associations in the heating and air conditioning industry.

Details of the program have been worked out by a steering committee made up of P. B. Zimmerman, chairman; C. E. Lewis, Delco Appliance Corp.; C. T. Burg, Iron Fireman Mfg. Co.; L. N. Hunter, National Radiator Co.; J. M. McClintock, Illinois Iron & Bolt Co.; C. D. Lyford, Minneapolis-Honeywell Regulator Co.; J. R. Scott, Mueller Furnace Co.; J. W. Grover, Surface Combustion Corp.; A. T. Atwell, Quaker Mfg. Co., and W. H. Knowlton, Airtemp Division, Chrysler Corp., secretary.

When the final organization of the Indoor Climate Institute is perfected as a non-profit corporation it will be governed by a group made up of individuals representing trade associations in the fields of boilers, controls, warm air heating, oil burning units, gas equipment, stokers, steel boilers and auxiliary equipment.

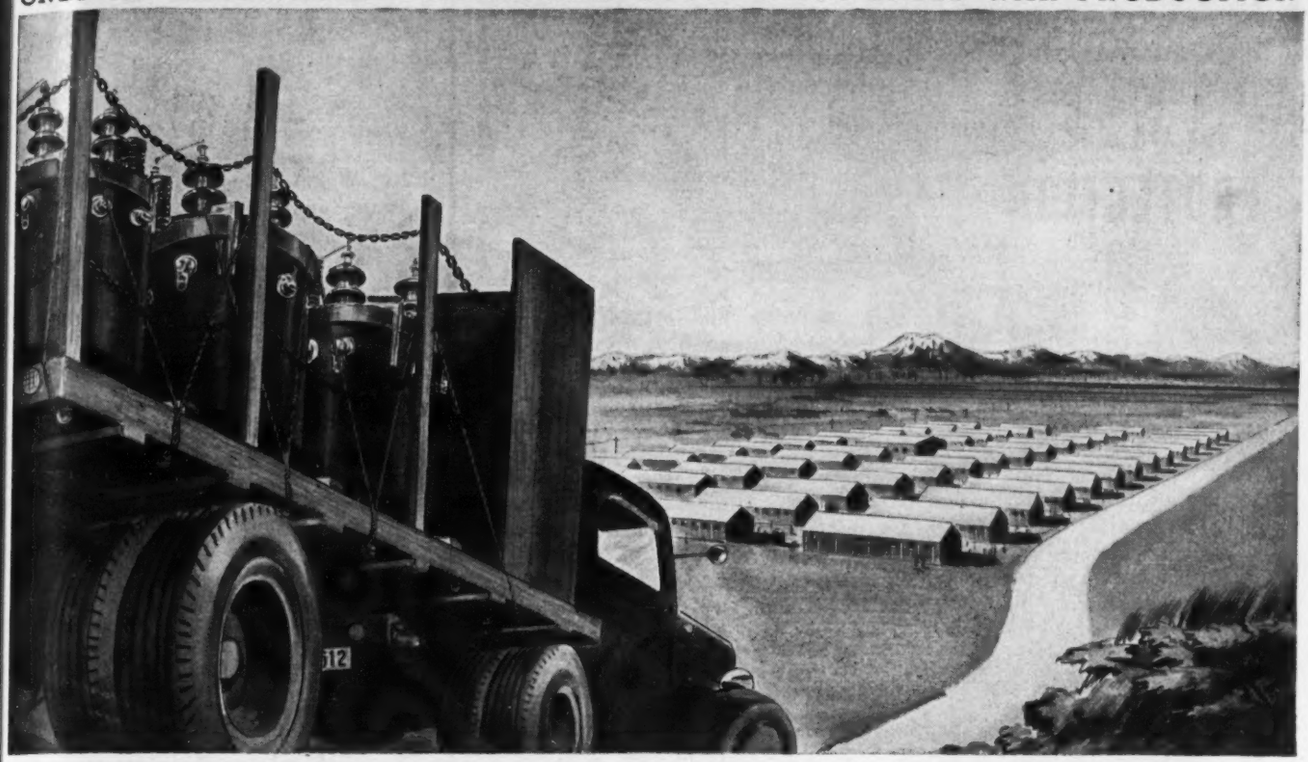
•

Anaconda Wire Reports Lower Net in 1943

Anaconda Wire & Cable Co., in a preliminary report for the quarter ended March 31, shows a net profit of $280,928 after charges and provisions for federal income and excess profits taxes and contingencies, equal to 67 cents a share on the 421,981 shares of capital stock. This compares with a net profit of $548,235, or $1.30 a share, for the quarter ended March 31, 1942.

The report states that it is impossible to estimate with any accuracy the amount which the company may be required to refund under the statute providing for renegotiation of war contracts or the effect of such renegotiation upon the financial results for the March quarter. However, an allowance for renegotiation was made in the computations.

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION



WESCO speeds "oasis" in desert

5-Way Phone Call Rushes 3 Transformers 740 Miles in 24 Hours to Parched Camp

4:45 P. M.—teletype from Army Camp in desert to Wesco House—"Rush immediately 3—15 KVA Transformers for water pumping system." *5 P. M.—phone call*—"Transformers must reach the camp within 24 hours." Within a few minutes Wesco located three transformers of the proper size but not of the exact characteristics specified.

Wesco immediately set up a 5-way telephone conference including the Army camp, Army Engineers office, electrical contractor, transformer manufacturer, and Wesco. The conference approved the transformers for the job and the 400-mile freight shipment to Wesco started that night. Arriving early next morning the transformers were loaded on a truck for the remaining 340-mile race across the desert and were at the camp, 740 miles from "home", less than 24 hours after Wesco received the order.

Scores of other examples attest the quick thinking, initiative and speed Wesco applies to war problems. Come Victory, this service will again aid industry and business everywhere.

WESCO SPEEDS WAR PRODUCTION

* A 3-story Army building covering 2½ acres was ordered to be built in 60 days. The local Wesco House provided 24-hour service, supplied 125 different electrical products made by 10 manufacturers.
* Lack of two electrical items threatened to tie-up an important war plant. Best delivery by manufacturers was 8 to 15 weeks. Wesco had the materials on the job in 2 days!

WESCO SERVES BUSINESS

* By providing trained sales and engineering personnel.
* By supplementing manufacturers' advertising with own sales promotion efforts.
* By providing engineering service in making up lists of materials and in preparing bids on jobs.

Westinghouse Electric Supply Co.

150 VARICK STREET • • • NEW YORK, N.Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES

A "SOUND" INVESTMENT IN PLANT PROTECTION

● With the installation of a modern system of A.A.I. Automatic Alarms, industrial plants enjoy the greatest possible measure of protection from an ever-threatening danger of sabotage, espionage and theft. By the ingenious use of tiny robot sentries, or detectors, attached at intervals along protective fence lines, the faintest of sound vibrations are instantly converted into both visible and audible signals to warn headquarters of danger and dispatch guards to the actual zone of disturbance. Here is dependable, round-the-clock, day and night protection, with fewer guards and greater security. Simple to install and maintain. Use Automatic Alarms to guard your particular properties and production.

Licensed under DuPont and Astatic Patents

Explanatory Literature is Available upon Request

SALES OFFICES: Philadelphia, Chicago, Pittsburgh, Detroit, Tulsa, and Toronto, Canada.

AUTOMATIC ALARMS *Incorporated*

848 MARKET STREET YOUNGSTOWN, OHIO, U. S. A.

for ECONOMICAL MAINTENANCE *and* OPERATION *Safe, Excellent Performance...*

VICTOR INSULATORS INC

VICTOR, NEW YORK

The Mark of Good Insulators...

Westinghouse Opens Blackout Plant

Opening of a new four-acre blackout plant on the East Coast to speed production of special type radio equipment for the Army has been announced by Walter Evans, vice-president in charge of the Westinghouse radio division.

Production of the plant will augment the radio division's output of communications equipment, already increased more than 40 times since start of the government's preparedness program, Mr. Evans said.

Designed to conserve critical materials, the new plant used 1,554,000 board feet of lumber, at an estimated saving of 1,920 tons of steel. It required the use of more than one acre of pressed wood panels in place of window glass. Westinghouse will operate the factory for the Defense Plant Corporation.

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following assignments to their sales staffs:

W. N. Matthews Corp. has appointed Harold C. Fiske, 732 Builders Exchange Bldg., Minneapolis, Minn., as Minnesota-North Dakota-South Dakota and western Wisconsin representative.

A. B. Chance Co. has transferred William A. Moss to the company's Kansas City office from the Atlanta, Ga., office. The Atlanta office has been temporarily closed, probably for the duration, due to wartime conditions.

Railway and Industrial Engineering Co., Greensburg, Pa., has appointed Garland-Affolter Engineering Corp. as sales representative to cover the West Coast. The Garland-Affolter organization maintains headquarters in San Francisco.

•

Nela Park Prepares Film on Victory Lighting

"Lighting Enlists for Victory" is the title of a new 35-mm. slide film prepared by the residence lighting section of lighting research laboratory of General Electric at Nela Park, Cleveland.

Consisting of 49 "frames," the film is accompanied by a descriptive text which briefly comments on each frame. Authors of the film are Mary Webber and Helen McKinlay, widely known home lighting experts at Nela Park. "Lighting Enlists for Victory" is designed to answer an urgent need for a new educational tool to help the average householder gear homelighting to wartime conditions.

Field Reports on Business

emand for industrial electrical power equipment is lessening. There is considable activity in special lines, small motors and small switch and control pparatus being features. Vegetable and fruit dehydration plants are becoming power factor on the Pacific Coast, providing considerable electrical business.

PACIFIC COAST

lectric power production in the seven tern states is averaging 20 percent ter than during the corresponding pe- of 1942 and is now totaling close to 0,000,000 kw.-hr. per quarter.

acific Coast wholesalers, despite their ter distance from most manufacturers, making somewhat better deliveries than year, and have achieved a fairly smooth ing schedule of advance ordering and icipated requirements. Staple wiring erial is averaging 60 days from date rder to date of receipt. Rubber-covered es take about 33 1/3 percent longer. pected price advances to cover the gov- ment's authorized price advance in rub- have been slightly reflected in recent ering.

ew government construction covers a 00,000 warehouse and navy machine p at Pocatello, Idaho; a $1,500,000 army ply depot in Los Angeles County; a 00,000 drydock award to Everett, sh.; $1,000,000 air force supply depots additions near Wenatchee, Wash., and Bernardino, Calif., and an additional A allotment to Bow Lake airport.

umerous vegetable and fruit dehydra- plants scattered throughout California the Pacific Northwest are providing siderable electrical machinery business are becoming a perceptible power tor. Latest installations cover seven s in Oregon and nine sites in Idaho.

alifornia manufacturing plants report e to 1,092,000 workers during early y, an increase, however, of only 2 cent over March, with a slight reduc- in shipyard workers. Seattle and Bonneville system are purchasing two of carrier-current and metering equip- nt. General Electric reports an order ering eighteen 100-kw. generator outfits miscellaneous equipment totaling 0,000.

NEW ENGLAND

hile the trend in sales of industrial ctrical power equipment is now down- rd and the demand for transmission supplies is lessening week by week, re still remains considerable activity special lines. Small motor sales are nforming to a pattern set by the machine l builders, who are buying regularly small lots. Small switch and control paratus outside government demands is rly active in connection with automati- ly governed processing in rayon and tile plants; tenders have been submitted Connecticut and Massachusetts manu- turers for supplying the Navy with dium-sized lots of electric soldering ns and electric air heaters, and bids ve been submitted by a prominent manu- turer for electric pumping units for p installations.

United Illuminating Co. has installed a 00-kva. Allis-Chalmers unit substation h load-tap-changing equipment in Pine , Bridgeport, Conn. Temporary build- s for Army service areas are being put requiring the minimum electrical sup- es.

Change-over for conducting special army d navy training courses in New England ucational institutions is reflecting sales of lighting units, alarm signaling systems and electrical metering and control apparatus. Government awards in non-electrical fields during the past week should sustain the level of activity prevailing in textile and rubber plants. New England retail trade is climbing and real estate markets in suburban Boston are humming in expectation of more favorable prospects for obtaining releases of more electrical supplies and apparatus for residential installations.

NEW YORK

Retail sales continue to increase by leaps and bounds, according to the Federal Reserve Board. Following a gain of 21 percent in department store sales for the week ended May 22, a gain of 42 percent was registered for the week of May 29, it was announced. In Boston the rise was 45 percent, in New York 37 percent and in Philadelphia 39 percent. Figures for the latest four-week period show an increase of 21 percent nationally. Inventories, on the other hand, continue to decline and the inevitable slowing up of sales, due to lack of consumer goods, would seem to be in the offing.

Civil engineering construction totaled $106,873,000 in the short week due to the Memorial Day holiday. This volume, however, was the highest reported since the week of November 12, 1942, according to the *Engineering News-Record*. It compares with $46,465,000 for the full preceding week, but is 61 percent below the total for the corresponding week last year. Construction for the month of May totaled $273,650,000—a decline of 40 percent from the previous month and 55 percent from the corresponding month last year.

CHICAGO

Comparison of various business indexes for April, 1942, and April, 1943, reflect the vigorous condition of industry and commerce in the Chicago area. Building contracts awarded (cost) and livestock slaughterings were the only items showing declines; 69.6 percent for the former 17.4 percent for the latter. Factory payrolls were up 32.3 percent; outgoing telephone calls, 8.8 percent; electric power production, 17.3 percent; department store sales, 9.9 percent; bank clearings, 15.7 percent, and postal receipts, 3.2 percent.

Several shifts have been made in the Chicago industrial scene which are notable for their post-war implications. Electronic Mechanics, Inc., Clifton, N. J., has recently purchased a 17,000-sq.ft. building in Chicago. Sylvania Electric Products, Inc., Salem, Mass., has rented a three story warehouse to be operated as a main distributing center. Expansion of the plastics industry in Chicago is reflected in the rush to complete a new and larger plant by the Chicago Die Mold Manufacturing Co.

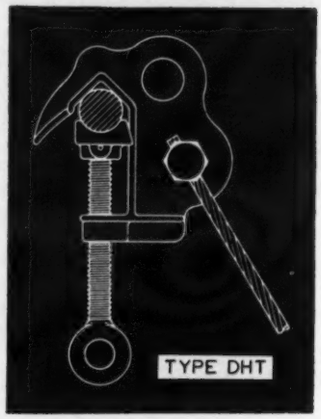
Western Electric Co., forced by war demands to extend local operations beyond its Hawthorne plant, has acquired another branch here. Westinghouse Electric & Manufacturing Co., having vacated former premises on Pershing Road at request of Army will occupy a plant on Kedzie Avenue in the city.

FOR CORRECT ENGINEERING STANDARDS SPECIFY SHELDON

SHELDON LIVELINE

for reasons of economy

A hot tap clamp used in distribution work for making either temporary or permanent connections.



9 Different Types to Choose From To Meet Any Range of Conditions

Some engineers use Sheldon Live-Line Clamps in place of low voltage disconnecting switches. And for reasons of economy!

Sheldon Live-Line Clamps are made of high strength bronze. Eye bolt will accommodate standard live line stick. They are available in Copper to Copper; Aluminum to Copper; Aluminum to Aluminum. The number of systems that have standardized on Sheldon Live-Line Clamps is your surest proof of satisfaction when you, too, choose to use it.

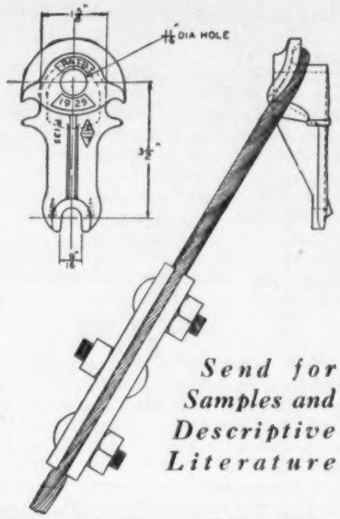
Complete dimensional data in our 80-page illustrated catalogue on over 200 different Sheldon Products made especially for Public Utility Systems. Do you have it on file?

SHELDON SERVICE CORPORATION Long Island City, N. Y.

"YOU'RE WELL CONNECTED WITH SHELDON"

Well Past the 1,300,000-Mark

Regular, although small orders for M.I.F. Through-bolt Guy Hooks were shipped all through 1942 to customers constituting over one-half the operating capacity of the U.S. and Canada. For shipments on orders bearing the usual preference ratings we have ample stocks of Guying Devices as listed below for use with 5/8" through-bolts, and larger sizes for 3/4" and 1" bolts, with safety factor over the bolt in each case.



Send for Samples and Descriptive Literature

These fittings may be advantageously used first where Through-bolt is already used to apply corner or dead-ending stresses to pole.

Test competitively with present guying specifications by sending assorted trial order at following 100-lot F. O. B. Branford prices:

P135 Guy Hook	$18.20/C
P128 Eye Nut	14.70/C
P143 Curved Washer	7.70/C
P126B Bolt Eye	24.50/C
PA-128-6 Anchor Rod (5/8"x 6 ft. Thimbleless)	66.70/C

Or, we will send sample P135, P128, and P143 without charge or obligation in response to request on Operating Company letterhead.

Use the Guy Hook for anchor guys, and the Eye Nut or Bolt Eye for pole to pole and other relatively flat guys, and the Curved Washer to minimize slotting or splitting stresses in the pole. Fully described in our Simplified Guying Specifications folder.

Misc. M. I. F. Pole Hardware Specialties:— *Williams Pole Mounts — Pole Stubbing Clamps—Aerial Cable Messenger Clamps and Insulated Hangers—Neutral and Ground Wire Clamps —Malleable Secondary Racks and Clevises—Tubular Pole Fittings—Transformer Hanger Plates for Through-bolt Mounting—Malleable Crossarm Gains—Screw Anchors—Sidewalk Guy Fixtures and Alley Arm Braces—Guy Strand Dispensing Holders—Through-bolts and Double-arming Bolts, etc.*

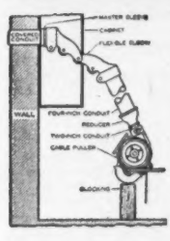
MALLEABLE IRON FITTINGS COMPANY
Pole Hardware Dept. [Factory and New England Sales Office] Branford, Connecticut
New York Sales Office: Thirty Church Street
Canadian Mfg. Distributor:
LINE & CABLE ACCESSORIES, Ltd., Toronto

YOU CAN DO THE JOB EASIER AND FASTER WITH A GREENLEE CABLE PULLER

● Here's a fast, easy way to pull cable that does away with cumbersome equipment and make-shift methods. There's no wear and tear on conduit hangers . . . the tool is portable . . . pays for itself on first few jobs.

← PULLING FROM EXPOSED CONDUIT

As shown at left, Puller clamps directly on conduit which serves as a positive anchorage. *Its unique design eliminates loosening conduit hangers by applying a holding force to the conduit itself — a force equal to the outward pull on the cable.* For clearance in close quarters, the adjustable tension drum can be swivelled around in full circle. Puller has two-speed gearing — maximum pull 7500 pounds.

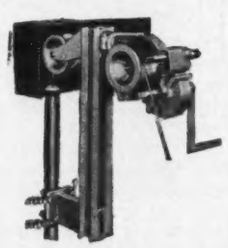


PULLING FROM CONCEALED ← CONDUIT

For concealed work a flexible elbow attachment is used. A fitting is connected to conduit, and the removable tension drum is attached to a suitable length of 4" conduit which serves as a connector to the elbow joints.

PULLING INTO JUNCTION BOX →

Here the Puller is set up for pulling into a junction box from a vertical conduit. In this photo, tension drum is swivelled around from position shown in the top picture. Special conduit adaptors are supplied for close quarters.



GREENLEE TOOL CO.
1806 COLUMBIA AVE.
ROCKFORD, ILL.

WRITE FOR FREE COPY CATALOG 33E
Get complete details on Cable Puller and other Greenlee tools for the Electrician that help speed up work . . . write for Catalog 33E.

Workers' Own Businesses Planned by Lincol

A savings plan to enable workers to start their own private business after the war has been announced by the Lincoln Electric Co. of Cleveland.

The prospective participant in the plan is sent an application blank for opening a savings account in the Harden office of the Cleveland Trust Co. When the coupon is returned to the bank with the first deposit in the form of a check, money order or currency, a savings passbook will be sent to the depositor, along with a form and self-addressed envelope for the next deposit. The applicant is encouraged to make deposits regularly so that by the time priorities on welding equipment and electrodes are lifted, he will have enough money to purchase them and to start in business. When the priorities are lifted, the Lincoln Electric Co. will announce the date on which it will be able to sell and ship the necessary equipment.

The savings account is protected by the Federal Deposit Insurance Corp.

•

Expands News Broadcasts

General Electric Co. expanded its radio news service to the public from three to six nights a week and increased the number of stations on the Columbia Broadcasting System carrying this news program from 60 to 11[illegible] when it began sponsoring the ten-minute news program "The World Today," 6.45-6.55 p.m., EWT, on May 3[illegible] This new program supplants the former news program sponsored by General Electric, carried at 6 p.m., EWT, for over a year on CBS.

•

Builds More War Plants

Standard Oil Co. of Indiana and subsidiaries are completing or have under way construction of manufacturing facilities estimated to cost upward of $55,000,000 which will contribute directly to the war effort, President Edward G. Seubert announced in his 1942 report to stockholders. For the most part they are financing the construction without aid from the government.

•

Suspend New Orders Data

The quarterly statistical series on new orders booked for electrical goods, compiled by the Bureau of the Census, has been suspended for the duration of the present emergency.

These Paragons of Performance

SAVE TIME!

★ *INDUSTRIAL TIMER*

The word Paragon means standard of excellence . . . and you get excellent performance in time-saving with Paragon Automatic Timers . . . on any one of a thousand jobs—conveyor operation, power disconnect, light exposure, liquid agitation, enamel baking, heat-treating, rubber curing, plastic molding, etc. Write us an explanation of one or more of your operations. A Paragon Timer Engineer will make complimentary suggestions.

WRITE FOR THIS BOOK

. . . Describing industrial Timers, Time Switches and other Time Controls. Contains illustrations, construction and installation data, list prices and reference information.

PARAGON ELECTRIC COMPANY
407 So. Dearborn St., Chicago, Illinois

Paragon Chicago
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

Sees Television as Vast New Industry

Television with its electronic eyes made sensitive to ordinary light will emerge from the war strongly qualified to become a vast post-war industry giving employment to many people in various fields associated with the new art, Ralph R. Beal, research director of RCA Laboratories, said recently in discussing "Radio—Electronic Research" before the Institute of Finance at the New York Stock Exchange.

Predicting unparallel progress in other fields as well as in radio, Mr. Beal said that the potentialities stimulate the imagination of research scientists to visions of new and unexpected horizons in the fields of physics, chemistry, metallurgy, biology and in many industries.

Commenting on the post-war prospects of television, Mr. Beal continued: "We now have electronic television. As an added service in broadcasting it has potentialities which surpass those of other mass communications services of information, education and entertainment. With post-war television broadcasting stations connected into networks, events of the nation will pass in review on the picture screens of home television receivers. Larger and brighter pictures of greatly improved quality will be realized and research and development plus genius in design and production will bring the television receiver set within the range of the average pocketbook. . . ."

•

Get Westinghouse War Memorial Scholarships

Four seniors in high schools stretching from Seattle, Wash., to Pittsburgh have been awarded this year's Westinghouse war memorial scholarships, established in 1919 as a memorial to the 5,000 men who left the company's shops and offices to fight in World War I. Employees and their sons under 24 years of age were eligible for the scholarships, worth $250 a semester in approved engineering schools of the winner's choice. The winners are: Theodore Gazda, Sharon, Pa.; James P. Lockwood, Hinsdale, Ill.; David A. Norton, Seattle, Wash., and William J. Veenis, Pittsburgh.

•

Storage Battery Sales

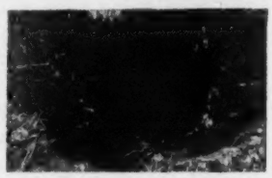
Sales of electric storage batteries and parts in Canada were valued at $1,959,432 during the first quarter of 1943, compared with $2,113,584 in the final quarter of 1942 and with $1,908,843 in the first quarter of 1942.

OSMOPLASTIC

SCORES A 4-ROUND **KNOCKOUT** OVER GROUNDLINE DECAY

ROUND 1

Dig earth from around pole to a depth of approximately 14 inches from the groundline. Then remove the loose decayed wood in the treatable zone.



ROUND 2

Apply OSMOPLASTIC by brushing or daubing on the cleaned surface from 6 inches above to 12 inches below the groundline level.

ROUND 3

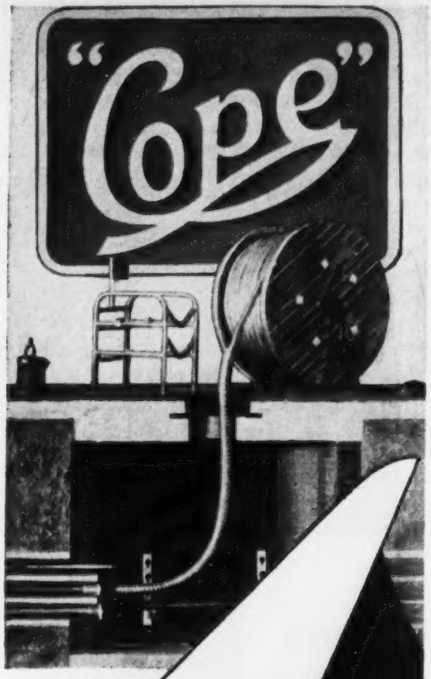
Wrap the Osmose bandage around the treated area. This protects and retains the Osmoplastic until the Osmosalts penetrate into pole.

ROUND 4

Back-fill the hole and the operation is completed. The Osmoplastic protection adds many extra years service to standing poles.

Write for full information TODAY!

OSMOSE
WOOD PRESERVING COMPANY OF AMERICA, INC.
BUFFALO, N. Y.
Denver • Chicago • New York • Kenova, W. Va.



UNDERGROUND EQUIPMENT

CONDUIT RODS
CONDUIT TOOLS
PULLING RIGGING
CABLE FEEDERS
CABLE RACK
CABLE ARM
COMPOUND KE
MANHOLE GU
MANHOLE L
MANHOLE CO
DRAWING-IN
CABLE

Only the Best for over 50 Years

WRITE FOR CATALOG

T. J. COPE, INC.
6120-6122 VINE STREET
PHILADELPHIA, PA.

Sales Opportunities

VIRGINIA—Virginia Public Service Co., Alexandria, has approved plans for addition to steam-electric generating plant, and will proceed with work at once. General construction contract has been awarded to Allen J. Savill, Inc., Electric Bldg., Richmond, and a number of sub-contracts will be let soon.

INDIANA—Studebaker Corp., South Bend, has contracted with government for further expansion in plants in Indiana and Illinois, comprising number of new buildings, with machinery and electrical equipment. Cost about $3,600,000. Financing by Defense Plant Corp. Proposed to begin work at early date.

NEBRASKA—War Department, Washington, D. C., has approved plans for new aircraft modification center, comprising hangars, shops and other industrial buildings, with mechanical and electrical equipment. Also power substation unit and distribution lines. Cost estimated over $1,000,000. Building award will be made soon and will be supervised by U. S. District Engineer Office, Omaha.

SOUTH DAKOTA—Black Hills Power & Light Co., Tinton, plans construction of power line, about 10 mi., for service for new mill to be constructed by Black Hills Tin Co., 1 North La Salle St., Chicago, Ill., for production of spodumene, replacing plant destroyed by fire a number of weeks ago. Plant will comprise several one and multi-story buildings, with machinery and electrical installation for large output. A power substation will be built at plant site. Entire development reported to cost over $400,000.

FLORIDA—Navy Department, Washington, D. C., has authorized expansion in three naval air training stations, including hangars, aircraft gun overhaul shop, metal-working and other industrial shops and miscellaneous buildings, with electrical and mechanical equipment. Entire program is estimated to cost $915,600 and will be carried out under direction of Bureau of Yards and Docks, Washington, D. C.

NEBRASKA—Platte Valley Public Power & Irrigation District, North Platte, plans new power substation, in connection with service to a municipality in that area.

KENTUCKY—War Department, Washington, D. C., plans extensions in air force base, comprising hangars, shops, warehouses and other buildings, with mechanical and electrical equipment. Also extensions in power substation, distribution lines and lighting facilities. Cost estimated about $1,000,000. Project will be supervised by U. S. District Engineer Office, Louisville, and will be carried out at early date.

CALIFORNIA—Navy Department, Washington, D. C., has authorized expansion in a naval air transport service base, comprising hangars, shops and other buildings, with electrical and mechanical equipment. Also additional distribution lines and power substations. Entire project will cost about $3,550,000 and will be carried out under direction of Bureau of Yards and Docks, Washington, D. C.

WISCONSIN—Board of Education, Beloit, plans complete modernization of electric lighting system in Merrill school, with installation of fluorescent fixtures in entire building. Estimates of cost are being

HIGH GRADE
HARD PORCELAIN
FOR
Electrical Specialties
High and Low Voltages

IMPERIAL
PORCELAIN WORKS
TRENTON, NEW JERSEY

Air Cooled TRANSFORMERS
Write for Air Cooled Transformer Bulletin

1/10 to 50 KVA single and 3 phase up to 2400 volts primary.

THE ACME ELECTRIC & MFG. CO.
43 WATER ST. CUBA, N. Y.

Acme Electric

Know Electricity as Experts Know It /

and Get an Expert's Pay

What about your future? Who is safe today? Surely the man who is contented to stand still! Know your thoroughly—prepare yourself for jobs ahead. To do this thousands of men have used

The Croft Library of Practical Electricity

The Croft Library is a complete electrical educator. It founded on practice—on 20 years of shirt-sleeve experien —on work as it is actually done. It is jammed from co to cover with the kind of hard-headed facts you wa Written so that the beginner can easily understand yet so sound, so thorough, that it is the daily guide 50,000 highly paid electrical workers and engineers. Cr tells you the things you need to know about motors, ge erators, armatures, commutators, transformers, circui switchboards, distribution systems—electrical machine of every type—illumination in its every phase—the m improved methods of lighting—lamps and lamp effec etc.—how to do a complete job, from planning it, completion.

No money down—easy payment

Fill in and mail the coupon attached and we will se you the entire set of seven volumes for ten days' Examin tion. We take all the risk—you assume no obligation. you decide to keep the books send $3.00 in ten days a the balance at the rate of $3.00 a month. Send t coupon NOW and see the books for yourself.

EXAMINATION COUPON

McGRAW-HILL BOOK CO., 330 W. 42nd St., N. Y. C.

Send me for ten days' examination on approval the Croft Library of Practical Electricity, 7 vols. If satisfactory I will send you $3.00 in 10 days and $3.00 monthly until the price of $18.00 is paid. If not wanted, I will return the books postpaid. (To insure prompt shipment write plainly and fill in all lines.)

Name .....
Home Address .....
City and State .....
Position .....
Name of Company ..... W. 6-12-43

made and application filed for a priority rating. V. F. Dawald is superintendent of schools.

WASHINGTON—Seattle Department of Lighting, Seattle, plans new reinforced-concrete, indoor-type power substation, including extensions in transmission line for power supply and additions to distribution system. Contract for building erection is scheduled to be awarded soon.

PENNSYLVANIA—Jacobs Aircraft Engine Co., Pottstown, plans expansion in plant for production for government, including new buildings and installation of machinery and electrical equipment. Cost estimated about $625,000, with financing by Defense Plant Corp. Work will begin at early date.

FLORIDA—War Department, Washington, D. C., has authorized expansion in air force base, comprising hangars, repair and reconditioning shops, warehouses and other buildings, with mechanical and electrical equipment. Also will make extensions in power substation, distribution system and lighting facilities. Entire project will cost about $2,000,000 and will be supervised by U. S. District Engineer Office, Jacksonville. Bids are scheduled to be asked soon.

WYOMING—Monolith Portland Midwest Co., Laramie, with local cement mill, affiliated with Monolith Portland Cement Co., 215 West Seventh St., Los Angeles, has negotiations under way with WPB for construction of new mill for production of alumina for government. It will comprise group of one and multi-story processing and production buildings, with machinery and electrical equipment for large output. Also power plant, machine and mechanical shops, storage and distribution buildings, and miscellaneous structures. Cost reported close to $4,000,000. It is understood that financing will be provided by Defense Plant Corp., when project is officially approved.

CALIFORNIA—Navy Department, Washington, D. C., has authorized expansion in a naval base, including shops, warehouses and other industrial buildings, with mechanical and electrical equipment. Also additions to distribution system and power substation facilities. Entire development will cost about $1,600,000, and will be carried out under direction of Bureau of Yards and Docks, Washington, D. C.

WEST VIRGINIA—Appalachian Electric Power Co., Roanoke, Va., plans new wharf for river coaling service at mouth of Cabin Creek, for coal supply for steam-electric generating station in that district, with complete coal-unloading and handling equipment. Application has been made for federal permission.

NORTH CAROLINA—U. S. Engineer Office, Wilmington, plans expansion and improvements in an airport, including hangars, shops and other structures, with mechanical and electrical equipment. Also will make extensions in electrical distribution lines and lighting system. Entire project will cost about $1,000,000. Work is scheduled to begin at early date.

WISCONSIN—Cudahy Water Works Co., Cudahy, has plans maturing for extensions in pumping station, with installation of electric-operated pumping units and auxiliary equipment, including construction of power line, about 7,000 ft., from local power plant of Cudahy Brothers Co., for power supply. Cost reported about $40,000. Application has been made to WPB for priority rating. Consoer, Townsend & Quinlan, 211 West Wacker Dr., Chicago, Ill., are consulting engineers.

tells you how to speed up your brazing with *preplaced*

EASY-FLO RINGS

The method of brazing terminal tubes to steel enclosures, switch boxes, lighting fixtures and other terminal boxes, with rings of EASY-FLO silver brazing alloy wire **preplaced**, is now virtually standard on construction of these units for marine service where strength, leak-tightness and fast production are paramount.

The EASY-FLO RINGS bulletin gives full details about the method and full instructions for applying it. And while it deals specifically with enclosures, the bulletin is very much of interest to all manufacturers of electrical equipment because the same method can be used to equal advantage on a wide range of other ferrous and non-ferrous metal brazing operations in the electrical field.

Preplacing EASY-FLO Rings substantially speeds up production and gives close control of the amount of alloy used.

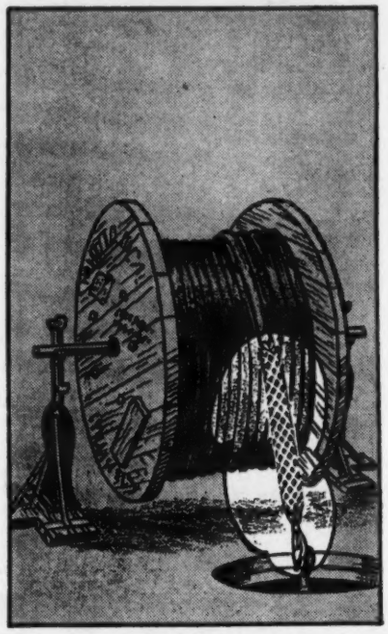
ARMY E NAVY
1ST AWARD August 1942
2ND AWARD February 1943

WRITE FOR A COPY OF THE EASY-FLO RINGS BULLETIN — TODAY

HANDY & HARMAN
HANDY & HARMAN FOUNDED 1867 QUALITY SERVICE
82 Fulton St.
New York N. Y.
Agents in Principal Cities
HANDY & HARMAN of Canada, Ltd., Toronto

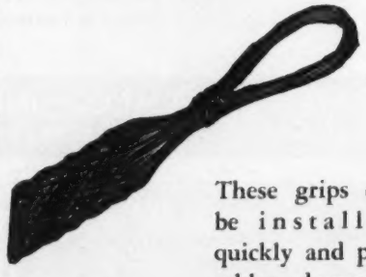
SPEED

CONSTRUCTION and EXPANSION of PLANT FACILITIES



RELIABLE CABLE GRIPS

For Pulling in Wires and Cable



These grips can be installed quickly and pull cables dependably. They do not let go halfway through a duct because the wires pull with evenly distributed load. Eight different styles — all supplied in a full range of sizes.

Reliable ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
1345 CARROLL AVENUE • CHICAGO, ILL.

ONE LITTLE HOOK

. . . that gives the Coffing "Safety Pull" Ratchet Lever Hoist superiority.

One little hook that will give you an easily converted double-power and double-duty hoist.

Write today for Catalog EG-6

COFFING HOIST CO.

Manufacturers of
Ratchet Lever, Spur Geared, Electric and Differential Hoists
Trolleys
Utility Maintenance Tools
DANVILLE - - - - ILLINOIS

Natvar

FLEXIBLE INSULATION!

VARNISHED CAMBRICS
VARNISHED PAPERS
SATURATED SLEEVING
VARNISHED AND LACQUERED TUBING
EXTRUDED TUBING
CABLE IDENTIFICATION MARKERS

In all commercial sizes, in accordance with standard and special specifications.

•

PROMPT SERVICE!
QUICK DELIVERIES!

•

THE NATIONAL VARNISHED PRODUCTS CORP.
211 Randolph Avenue, Woodbridge, New Jersey

Test Insulation the Modern Way
with a MODEL B-5
MEGOHMER

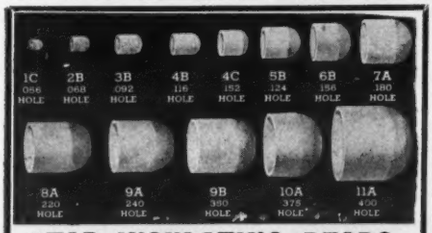
VARIOUS NEW MODELS AND RANGES

NEW BATTERY-VIBRATOR TYPE

No more tiresome cranking of a hand-driven generator . . . Entirely self-contained, steady test potential of 500 volts DC, available at the touch of a switch. Direct reading in insulation resistance.

HERMAN H. STICHT CO., INC.
27 PARK PLACE NEW YORK, N. Y.

WRITE FOR BULLETIN No. 430



STAR INSULATING BEADS

Use LAVOLAIN ball and socket beads for insulating bare wire. Heat resistant. High di-electric and mechanical strength. Made in U.S.A. Quality beads at low cost. Quickly applied. Flexible. Beads shown above are approximately half actual size. Ask for price list and samples.

STAR PORCELAIN CO.
51 Muirhead Ave. Trenton, N. J.

G.C.A.
Lamp Replacers
Lamp Base Removers
Cartridge Fuse Tongs
Switch Hooks

Send for Catalogue

We have been making safety tools for 27 years

THE G. C. A. Manufacturing Co.
Pittsfield, Mass.

Relax Order on Portable Fan Parts

Use of copper and copper base alloys in the production of replacement parts for portable electric fans which conduct current, is permitted by a revision of Order L-176. Previously only steel parts could be manufactured.

With this relaxation to keep the nation's existing supply of fans in operation, WPB added to the order a requirement that used parts must be turned in for each new replacement part installed. In addition, manufacturers are limited in the volume of parts production to that of their sales of parts during the last six months.

Definition of "electric fans" also is revised in the order to include the wall type propeller fan having a blade diameter of less than 17 inches and all ceiling fans. Electric fans now are produced only for naval and maritime orders. Existing stocks of new fans are released upon WPB authorization, usually for hospitals and similar institutions.

•

Refrigerator Warehousing Charges Allowed by OPA

Addition of warehousing charges to the ceiling prices of mechanical refrigerators frozen by WPB has been authorized by the Office of Price Administration.

Allowable charges are 1 percent per month between February, 1942, or the date when the refrigerator was placed in the warehouse, and September 13, 1942, plus $5 per unit between May 1 and December 31, plus $10 per unit after December 31.

Under no circumstances, OPA ruled, may the warehousing charge be passed along to domestic purchasers.

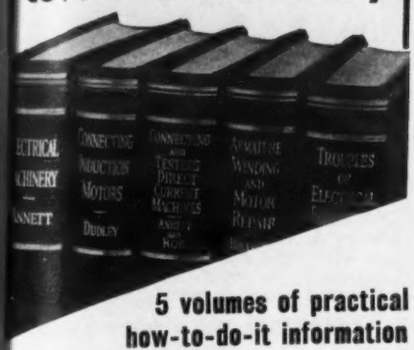
•

Province-Wide Rate Cuts Announced by Board

Province-wide reductions in domestic power bills for customers of the Manitoba Power Commission went into effect with the April billing, Herbert Cottingham, chairman, recently announced.

These reductions include abolition of the 55-cent monthly service charge, increase of the first block energy unit minimum from 35 kw.-hr. to 50 kw.-hr. and lowering the rate from 9 to 8 cents. Reduction of the rate and increase of the minimum will affect a large number of consumers who use less than 50 kw.-hr. per month. The usual 10 percent discount for prompt payment still continues.

Every phase of electrical maintenance and repair work covered in this library



5 volumes of practical how-to-do-it information

Every man concerned with the care and repair of electrical machinery should have these practical books, with their helpful tables, diagrams, data, methods and kinks. Every one of the five volumes is jammed to the covers with sound, how-to-do-it information—the kind you have to have when anything goes wrong. Liberal use has been made of practical data and practice in repair shops so as to combine the good features of a library of methods with handbook information covering these methods.

Electrical Maintenance and Repair Library

2042 pages, 1721 illustrations and diagrams

These books show you how to

—install all types of motor and generator units;
—locate breaks in armature windings and do a workmanlike job of rewinding;
—know just what is wrong with an electrical machine and take charge of installation and maintenance work;
—make accurate tests of switchboards and apparatus and correctly balance the power with the load;
—handle every sort of wiring job;
—show competence, whether it be in the use of a Stillson wrench of a Wheatstone bridge.

Includes trouble-shooting book

Now, in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a handy book giving helpful maintenance information, special trouble-shooting charts, explanations of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

10 days' examination
Easy monthly payments

We want you to examine this Library for 10 days. If you don't want them at the end of that time, there's no obligation to keep them. On the other hand if you decide you want the help these books can give, start the small monthly payments then, and in a short time the books are yours, right while you have been using them. Send the coupon today.

EXAMINATION COUPON

McGraw-Hill Book Co., Inc.,
330 W. 42nd St., New York, N. Y.

Send me Electrical Maintenance and Repair Library, 5 volumes, for 10 days' examination. If I find the books satisfactory, I will send you $1.00 in 10 days, and $2.00 a month until $15.00 has been paid. Otherwise I will return the books postpaid.

Signature .....
Address .....
City and State .....
Firm or Employer .....
Position ..... W. 6-12-43

The commission experimented with these reductions last summer in nine towns. A study of the results showed it worked satisfactorily and the commission decided to make the reductions applicable to the remaining 142 towns and villages served by the commission.

•

Recent Rate News

TAMPA ELECTRIC CO. lost a decision in the Florida Supreme Court recently when that body ruled that Florida courts have the right to determine reasonable utility rates. The suit was instituted by three suburban customers of the power company, who contended that they were entitled to a rate reduction of 18 percent voluntarily given by the company to customers inside the city limits on October 1, 1942. They also contended that they were entitled to a 30 percent reduction granted customers within the city limits under an order of the Tampa Utility Board. In an appeal from Circuit Judge Harry Sandler's ruling, the Tampa Electric Co. contended that the regulation of utility rates was a function of the legislature, unless the legislature had delegated regulatory duties as it did to the Tampa Utility Board. The court held that the "rule of common law is that utility rates must be reasonable and not discriminatory." Since the legislature did not make provision for regulation of the company's rates outside the city limits, the court held that rural customers could "seek redress under the common law."

LOS ANGELES WATER AND POWER COMMISSION has adopted a new schedule of rates, which will effect an annual saving of approximately $2,100,000 for electricity users in Los Angeles. The schedule will be submitted to city council. The new schedule would include a reduction of $160,000 on street-lighting assessments and a saving of $1,950,000 to residence and other users. The figure for residential electric bills would be cut 4.1 percent under the schedule; for general lighting, including offices, 8.6 percent and for general power, including factories, 6.4 percent. A similar scale of reduction was voted by the commissioners before Pearl Harbor, but was held up by the council.

ROUSES POINT, N. Y., which operates a municipal electric plant, has been granted permission by the New York Public Service Commission to revise its rate schedules. The new schedule will result in savings of approximately $1,000 annually to its customers.

•

Recent Legislation

FLORIDA—The bill providing for state regulation of privately owned electric power and gas companies and their rates and services (ELECTRICAL WORLD, May 29, page 117) was killed recently in the House by a vote of 63 to 30.

OHIO—Legislature, scheduled to complete its current session by June 10, recently completed enactment of the 1 percent utilities excise tax bill, revenue from which will be used for poor relief purposes. The measure is for two years. A proposal to tax municipally owned utilities was killed in the House taxation committee.

MATTHEWS SECONDARY CUTOUTS.

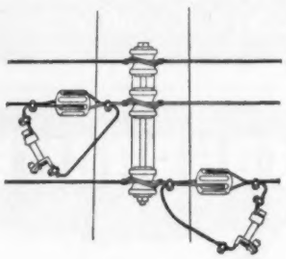
Rating:
100 Amperes 250 Volts
Rupturing Capacity
5000 Amperes

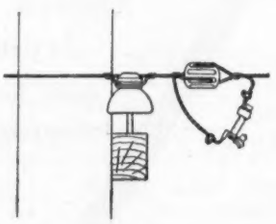
You can fuse them with any make of standard primary fuses.

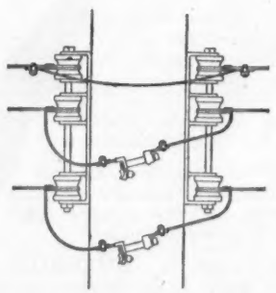
They indicate outages.

For isolating service entrance faults; for protecting banked transformer secondaries; or for protecting transformers from secondary faults, Matthews Secondary Cutouts have proved themselves very efficient and low-in-cost for many years.

For Sectionalizing as shown below.



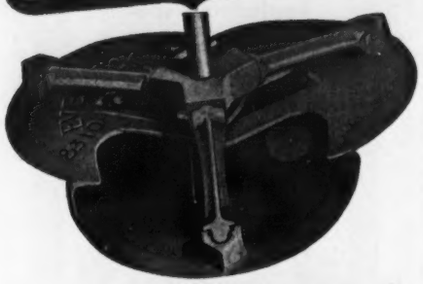




Send for Bulletin 101-A.

W. N. MATTHEWS CORPORATION
ST. LOUIS, U. S. A.

EVERSTICK ANCHORS...



FOR SPEED IN INSTALLATION

The exclusive Everstick nut housing locks the Anchor firmly on the rod. This speeds up installation. Plates are so designed, that they expand easily into undisturbed earth, and extra holding power is achieved. Made of tough, rust-resistant malleable iron. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

COHARDITE
INSULATED TOOLS

Reduce Accidents and Service Interruptions

#155 SCREW DRIVER
List Price $1.10

A long, thin, well-insulated screw driver. Ideal for reaching deeply recessed screws. Made with Stanley 100 plus quality blade to U. S. Navy specifications. COHARDITE insulated all the way down the blade to within 3/8" of the point.

Every tool tested to its full rated dielectric strength of 10,000 volts for one minute RMS before it leaves our plant.

A full range of COHARDITE insulated small tools carried in stock for meter and distributor departments.

Send for a catalog.

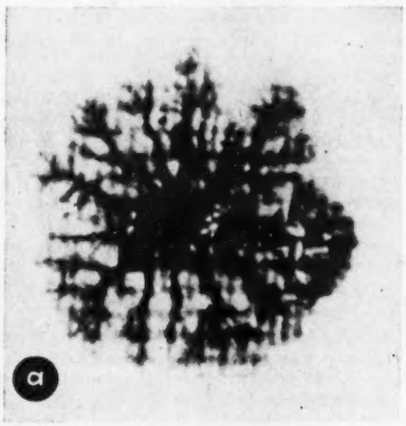
THE CONNECTICUT HARD RUBBER CO.
408 East Street, New Haven, Conn.

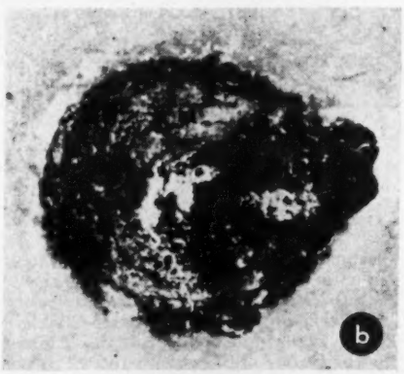
LETTERS TO THE EDITOR

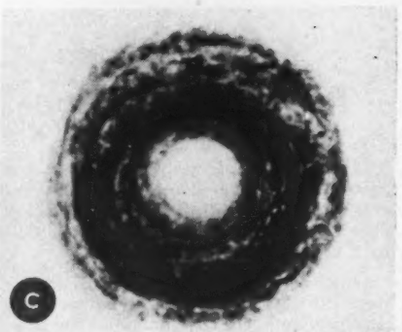
Plastic Arc-Tracking

To the Editor of ELECTRICAL WORLD:

It was gratifying to find Mr. Richardson, in his article "Background for Electrical Properties of Plastics," in the ELECTRICAL WORLD of April 17, 1943, express the belief that the subject of arc resistance of nonflexible plastic materials is one of considerable importance to the electrical industry. The "time-to-failure" of different plastic materials when subjected to the standard A.S.T.M. arcing test varies for different



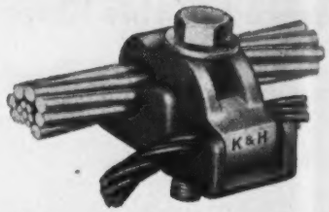




EXAMPLES of current-exposure patterns on plastic materials which (a) track readily, (b) track less readily, (c) do not track

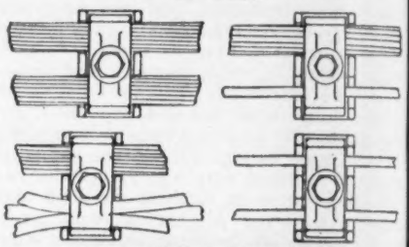
is no better than its

UNIVERSAL Tap Connector



Effectively used as guy line ground, or transformer and lightning arrester connection to A. C. S. R. or copperweld conductors where the diameters may be from 8-A copperweld to .595" A. C. S. R. armour rods. Wire sizes .595" to 5/32".

ADAPTABLE TO A WIDE RANGE OF USES



★ **WRITE FOR BULLETIN 8-B** ★

K&H KRUEGER & HUDEPOHL
Solderless Terminal Lugs and Connectors
E. VINE AT THIRD • CINCINNATI, OH

What Makes a Mailing Click?

Advertising men agree . . . the list is more than half the story. McGraw-Hill Mailing Lists, used by leading manufacturers and industrial service organizations, direct your advertising and sales promotional efforts to key purchasing power.

In view of present day difficulties in maintaining your own mailing lists, this efficient personalized service is particularly important in securing the comprehensive market coverage you need and want. Investigate today.

McGraw-Hill Publishing Co., Inc.
DIRECT MAIL DIVISION
330 West 42nd St., New York, N. Y.

SOLID SHANK

The Strongest Known Shovel

• The Sturdee *Solid Shank* Telegraph Shovel is forged in one piece from a solid bar of steel.

It is exclusive in construction —the strongest shovel known.

America's largest shovel users —railroads, mills, mines—specify, use and universally acclaim Solid Shank as first in utility, service life and economy.

Every light, power, and communications user who has tested this shovel now standardizes on Sturdee Solid Shank—they will have no other.

Reduced costs will follow if you specify Sturdee Solid Shank for all telegraph shovels.

STURDEE TOOLS
a TRUE TEMPER PRODUCT

Cross-section at right illustrates the solid shank, one piece construction of Sturdee Telegraph Shovels. 22 inch, straight handle socket. 13 gauge, heat treated blade. XX grade hickory or ash handle, sanded and waxed. Length 6 feet to 12 feet.

Distributed by
JOSLYN MFG. & SUPPLY COMPANY
Executive Offices
20 North Wacker Drive • Chicago, Illinois
Branches and Warehouses with Complete Stocks in Principal Cities of the United States

materials, as pointed out by the author ("a few seconds for phenol formaldehyde as against 200 seconds for melamine resin compounds"); however, it should be emphasized that different plastic materials have different inherent characteristics when subjected to arcing conditions. That is, certain materials (such as phenol formaldehyde, aniline formaldehyde, melamine formaldehyde, etc.) are inherently "tracking" in nature and form a permanent conducting carbonaceous path in the material when subjected to arcing, whereas other materials (such as urea formaldehyde, cellulose acetate, styrene, etc.) are inherently "non-tracking" in nature and burn and/or volatilize when subjected to arcing condition, but do not form a conducting path in the material.

The accompanying illustrations show the nature of decomposition of various materials when subjected to conditions whereby an electric current passes over the surface of the materials.

E. C. DeBaene,
Research Department,
Detroit Edison Company.

•

Refrigerator Servicing to Be Done by Women

Women are now being recruited in every one of the 48 states to help keep the nation's 19,000,000 electrical household refrigerators operating efficiently to prevent waste of any vital foods, it was disclosed at the headquarters of the National Electrical Manufacturers Association in New York.

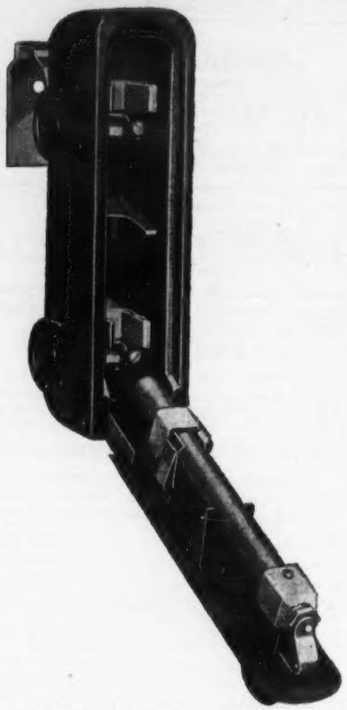
Charles R. D'Olive, chairman of the household refrigeration section of NEMA, reported that many major manufacturers of electric refrigerators have organized service training programs in which women as well as older men and boys are filling the ranks of skilled appliance service men who are now in the armed forces. In addition, the industry is sponsoring educational programs to train the women in the homes to lengthen the life of their refrigerators.

•

Five Radio Parts Standardized by WPB

Five parts for home radios are standardized by Order L-293, which becomes effective July 1. They are dry electrolytic and fixed paper-dielectric condensers, power and audio transformers and reactors. Parts produced to standard specifications will bear brand names. WPB may authorize manufacture of non-standard parts for those sets which cannot accommodate the standard parts.

Non-Indicating Porcelain Housed Matthews Cutouts.



ALMOST AS SIMPLE AS A PIN.

Ratings
30, 50 and 100 Amperes
2½, 5 and 7½/12½ Kv Grd. Y
Interrupting Capacities
600, 1200 and 3000 Amperes

WHY THEY ARE LIKED

Simple* — Rugged — No Moving Parts — Heavy Everdur Set Screws — All Current Carrying Parts Over 85% Copper Content — Time-seasoned Bakelite Covered Fibre Fuseholder Tubes Which Won't Warp — High Flashover Values — High Interrupting Capacity — Lowest Time-cost — Over 500,000 In Use. No essential changes in design in over fourteen years, but many refinements have been made.

*Remember: Simplicity means freedom from operating troubles.

Send for Bulletin 103.

W. N. MATTHEWS CORPORATION
ST. LOUIS, U. S. A.

PROFESSIONAL SERVICES

BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

H. F. FERGUSON

Consulting Electrical Engineer

Rate Investigations and Comparisons
Plant Surveys—Reports

288 Alameda Avenue Youngstown, Ohio

J. H. MANNING & COMPANY

ENGINEERING
SERVICES

120 BROADWAY, NEW YORK

BLACK & VEATCH

Consulting Engineers

Water, Steam and Electric Power Investigations, Design, Supervision of Construction, Valuation, Tests and Laboratory Service.

4706 Broadway, Kansas City, Mo.

ROBERT E. FOLEY CONSTRUCTION CORPORATION

Rural Lines—Transmission Lines
Fire Alarms—Telephone Lines

48 Griswold St. Binghamton, N. Y.

DANIEL W. MEAD
F. W. SCHEIDENHELM

Consulting Engineers

Hydro-Electric Development, Dams, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law. Appraisals.

New York City, 50 Church St.

E. J. CHENEY AND CO.

ENGINEERS AND CONSULTANTS

Design, Supervision of Construction
Rehabilitation Engineering, Reports, Studies
Valuations, Economic and Business Surveys

61 Broadway New York

FORD, BACON & DAVIS, Inc.

ENGINEERS

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS

New York — Philadelphia — Washington — Chicago

ARTHUR L. MULLERGREN

Engineering-Management
Public Utilities—Natural Gas

Kansas City, Mo.

COLUMBIA ENGINEERING CORP.

STRUCTURAL, MECHANICAL & ELECTRICAL ENGINEERS

War Plant Design - Supervision of Construction - Engineering Reports

61 Broadway New York, N. Y.
323 Plum Street Cincinnati, Ohio

FRANK F. FOWLE & CO.

Electrical and Mechanical
ENGINEERS

35 East Wacker Drive Chicago, Ill.

Recording & Statistical Corp.

BILL ANALYSIS—CONSUMPTION STUDIES
THE ONE-STEP METHOD

Bill Frequency Analyzer

102 Maiden Lane New York

HUGH L. COOPER & CO. INC.

General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.

30 Rockefeller Plaza New York

GILBERT ASSOCIATES, INC.

Engineers and Consultants

DESIGN, CONSTRUCT, OPERATE & MAINTAIN INDUSTRIALS AND PUBLIC UTILITIES

Reports • Rates • Labor relations • Safety • Purchasing • Costs • Laboratory

61 Broadway New York Reading, Pa. National Press Bldg. Washington, D. C.

SANDERSON & PORTER

Engineers
for the
FINANCING—REORGANIZATION—
DESIGN—CONSTRUCTION—
of
INDUSTRIAL and PUBLIC UTILITIES

Chicago New York San Francisco

JULIEN H. DAVIS

Member A.I.E.E.

Consulting Engineer

Industrial
Utility—Electrical—Mechanical

740 So. Broadway Los Angeles, Calif.

HENKELS & McCOY

(Electric & Telephone Line Construction Co.)

Wood pole transmission lines
Electric Distribution and maintenance

Philadelphia, Pa.

SARGENT & LUNDY

ENGINEERS

140 South Dearborn St.

Chicago, Ill.

DAY & ZIMMERMANN, INC.

ENGINEERS

Design - Construction - Management
Investigations and Reports

NEW YORK PHILADELPHIA Packard Building CHICAGO

HOOSIER ENGINEERING COMPANY

Erecting Engineers
Transmission Lines, Substations

46 So. 5th St., Columbus, Ohio
327 South LaSalle Street, Chicago, Ill.
136 Liberty St., New York

STONE & WEBSTER ENGINEERING CORPORATION

Design and Construction
Reports • Examinations • Appraisals
Consulting Engineering

BOSTON • NEW YORK • CHICAGO • HOUSTON
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

Ebasco Services Incorporated

Industrial Division

Design and Construction
Financial and Operating Consultation
Investigations and Reports
Consulting Engineering

Two Rector Street New York

WILLIAM S. LEFFLER

succeeding
CHARLES F. LACOMBE—WILLIAM S. LEFFLER
Engineers—Economists
RATE RESEARCH — SALES RESEARCH
FOR
POST-WAR PLANNING
Cost Analysis Rate Cases

Noroton, Connecticut

WELSBACH ENGINEERING AND MANAGEMENT CORPORATION

Engineering - Electrical Construction - Management - Electric and Gas Street Lighting Maintenance

1500 Walnut Street Philadelphia, Pa.

Electrical Testing Laboratories Inc.

WAR WORK TESTS

ELECTRICAL — MECHANICAL — PHYSICAL — CHEMICAL — for compliance with Government Specifications.

Inspection—Analysis—Research—Certification

2 East End Avenue at 79th Street New York

CHAS. T. MAIN, INC.

Engineers

Boston, Mass.

Electric, Steam and Hydraulic Projects. Investigations, Reports, Designs and Appraisals.

THE J. G. WHITE ENGINEERING CORPORATION

Engineers — Constructors

New York, N. Y.

BOOKS RECEIVED

Principles of Magnaflux Inspection. Second Edition. By F. B. Doane. Photopress, Inc., Chicago, Ill. 288 pages, illustrated.

The author is an executive of the corporation which developed Magnaflux. The treatment starts with a detailed discussion of magnetization methods and manifestations in a thorough qualitative way not found in textbooks. Then follows a detailed discussion of the equipments and the various flaw detection and interpretation procedures and a citation of numerous types of flaws encountered in practice. Inspection of welds and the techniques of preliminary demagnetization conclude this explication of a unique tooling by which industry can uncover incipient defects that may end in disastrous consequences.

High-Frequency Thermionic Tubes. By A. F. Harvey. John Wiley and Sons, Inc., New York. 235 pages, illustrated. Price $3.

Treats the performance and limitations of conventional tubes at ultra high frequencies, emphasizing the anomalies arising when electron transit time becomes a dominant factor in behavior and design. For the radar engineer it should suffice to say that more than half the book is devoted to the retarding field generator, the magnetron, rhumbatron and klystron. No claim is made that the theory of operation has been fully pinned down mathematically but there appears to be more quantitative and specific data and tooling about UHF tubes than has been vouchsafed in any other assembly. Velocity vs. stream modulation and wave guides are other aspects brought into this Oxford report of researches into very high frequencies.

Magnetic Circuits and Transformers. By members of the staff of the Department of Electrical Engineering, Massachusetts Institute of Technology. John Wiley & Sons, Inc., New York. 718 pages, illustrated. Price $6.50.

Few basic textbooks reflect as representative a matching of practice with theory as does this. For that reason the rising engineer should find the treatment far more than a "refreshener" book. Whether in design or performance objectives, the examples worked out are more practical and pertinent than any practicing engineer is likely to have had in no matter what course of his day—that penetrating, elucidative and current is the subject matter. Samples of timely but elusive phenomena painstakingly treated are mixed magnetic circuit computations, optimum magnets, incremental permeability, harmonics of excitation, transformer thermics, economic proportioning, per unit analysis, loss factor, instrument transformers (linear couplers, however, omitted), merits of various connections in emergency service, unbalance, zigzag- and multi-1windings. Significant conclusions and formulas are marked in a distinctively visible way.

Foremanship and Safety. By C. S. MacMillan, John Wiley & Sons, New York. 101 pages, illustrated. $1.

Foreman is key to accident prevention. All 27 short chapters are addressed in horse-sense language to him and each carries a "talk" phrased most succinctly for him to win the confidence and support of his men. Essentially industrial but broadly educational.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : "OPPORTUNITIES" : EQUIPMENT
BUSINESS : : USED OR RESALE

UNDISPLAYED ——RATES—— DISPLAYED

10 CENTS A WORD. MINIMUM CHARGE $2.00.
Positions Wanted (full or part time salaried employment only) ½ the above rates payable in advance.
Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Individual Spaces with border rules for prominent display of advertisements.
The advertising rate is $7.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by Monday will appear in Saturday's issue, subject to limitations of space available.

To A Research Engineer with Ideas

We are a relatively young but fast growing concern in the Middle West, specializing in transmission and distribution equipment. We have a small but most modern plant and a fine research department. We flatter ourselves for being aggressive merchandisers.

We are looking at present for an electrical engineer of resourcefulness to help us in the design of new equipment for the electrical utility industry. He should have some practical experience but mainly a lot of sound imagination and ideas.

To such a man we can offer a very satisfactory income, an excellent opportunity for promotion and a permanent connection with a financially strong organization.

If you feel you meet these qualifications and if you are not now in a full time war job, we wish you would write us. We might have just what you had always hoped for.

P-547, Electrical World
520 N. Michigan Ave., Chicago, Ill.

MERCHANDISING DIRECTOR

WANTED

SALARY $10,000 to $15,000 per year. Permanent position. Applicant to qualify must have selling, organizing and executive ability, plus engineering training. Age 40 to 47. Replies to be held in strict confidence. Our organization knows of this advertisement. P-557, Electrical World, 520 No. Michigan Ave., Chicago, Ill.

POSITION VACANT

FIRE PROTECTION ENGINEER and Inspector. Permanent positions open in New York, Pennsylvania, or the Middle West with large industrial fire insurance organization. Previous knowledge in this work not necessary. Applicant must be a technical graduate with manufacturing or engineering experience, and possess a good personality. Send photo with letter. Men subject to draft for military service cannot be considered. P-559, Electrical World, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS — This advertising service of 33 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. BIXBY, Inc., 262 Delward Bldg., Buffalo, N. Y.

Meter Man Wanted

Municipal Utilities, experienced, sober, studious, draft exempt, Read and Test Meters, General Service and Records. Salary $230 monthly, forty hour week, also vacation, sick leave, pension, life insurance. Fare paid, permanent, Pacific Northwest, population five thousand, Exceptional fishing and hunting, air mail qualifications, references covering experience, and character.

P-555, Electrical World
68 Post Street, San Francisco, Calif.

(Additional Employment Advertising on the following page)

POSITIONS WANTED

ELECTRICAL ENGINEEER: Age 45 years, 24 years professional engineering experience, 20 years in the public utility field, 18 years in responsible charge of engineering work; at present employed as Assistant-Chief Engineer of Public Utility. Desires an engineering or executive position with utility or electrical manufacturer. PW-553, Electrical World, 330 W. 42nd St., New York, N. Y.

MANAGER—Wide experience all phases of local and territorial operation and management electric, gas, water, ice, heating, etc. Steam, hydro, and diesel. Public relations specialist. Past ten years with present connection. Satisfactory references. Would consider change where ability needed. Past draft age. PW-554, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

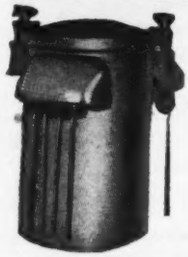
ELECTRICAL ENGINEER — Draft Exempt. Extensive experience, operation, maintenance, construction as Estimating Engineer, Distribution Engineer, Division General Superintendent. Also experience in design, layout and supervision of construction for large electrical construction company. Now operating own business. PW-560, Electrical World, 330 W. 42nd St., New York, N. Y.

DRAFTSMAN—Age 37, 18 years experience electric and gas utility, construction, drafting and design. Married, one child. Desire permanent location. Best of references. PW-561, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER
AVAILABLE JULY FIRST
with transmission line and substation construction experience, also vapor tight and explosion-proof wiring.
PW-556, Electrical World
520 No. Michigan Ave., Chicago, Ill.

PRIME **LOANS** TO
CORPORATIONS—Unsecured
INDIVIDUALS—Collateralized
LARGE Sums—LOW annual rates.
COLLATERAL DISCOUNT CORP.
Graybar Bldg.—New York City

Sales Manager
WANTED
SALARY $10,000 to $15,000 per year. Position permanent. Necessary experience to qualify requires sales and engineering training plus executive experience. Age 40 to 49. All replies will be held strictly confidential. SW-558, Electrical World, 520 No. Michigan Ave., Chicago, Ill.

-TRANSFORMERS-

TRANSFORMERS WANTED
in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.
We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Prices quoted on request.
THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

FOR SALE
(additional For Sale ads on opposite page)

Power Equipment
Released by Utilities & Industrials
Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries, Transformers, Motors, Compressors, etc.
Service backed by 38 years' experience
BREW, WOLTMAN & CO.
30 Church St., New York

FREQUENCY CHANGER
1400 HP 460 volts, 3 phase, 60 cycle, 300 RPM, 1570 ampere, 1250 KVA, p.f. 0.9, 50-deg. rise, type ATI-24-1250M-300 form C, with amortisseur winding; with
1000 KW 460 volts, 3 phase, 25 cycle, 300 RPM, 1570 ampere, 1250 KVA 0.8 p.f. 50-deg. rise, General Electric, type ATI-10-1250M-300, with amortisseur winding, with 33 KW direct-connected exciter.
CHICAGO ELECTRIC CO. 1314 W. CERMAK RD. CHICAGO, ILL.

FOR SALE
TRANSFORMERS-USED
Released from completed project
10 to 100 KVA
6600 - 120/240
6600 - 240/480
6600 - 110/220
Also—Instrument Current
Instrument Potential
COLEMAN BROS. CORP
Franklin Falls Dam Franklin, N. H.

LARGE G. E. INDUCTION MOTORS
10—2500 H.P. General Electric Induction Motors — Type MT-28-2500-257 FORM AE, 3 phase, 60 Cycle, 6600 Volts, 257 R.P.M. with starting equipment.
1—1500 H.P. General Electric, Induction Motor — Type M.T.-28-2500-257 FORM AE, 3 Phase, 60 Cycle, 6600 Volts, with starting equipment.
15—25 K.V.A. Transformers, Distribution G.E. Type H. Single phase, 60 cycle 5940/6600/11430Y to 230 Volts
6—15 K.V.A. Transformers, Distribution, G.E. Type H. Single phase, 60 cycle, 5940/6600/11430Y, to 115 Volts
3—Cable Reels 11' dia. 10' long.
USED A SHORT PERIOD ONLY
WIRE—WRITE—PHONE
SAMUEL HUBERMAN
223-225 No. 4th St. TEL. EVERGREEN 7-3277 Brooklyn, N. Y.

SUCCESSFUL OPERATION GUARANTEED

Every Machine in This Ad is Owned Outright By Us

D C MOTORS

HP	Make	Type	Volts	Speed
1500	Whse.		550	330
1250	G.E.	MPC	550	130
800	G.E.	MPC	600	600
625	G.E.	MPC	500	130
600	G.E.	MPC	600	650/900
600	Whse.		250	150/275
350	G.E.	MPC	230	450
300	G.E.	DMC	230	400/600
300	Cr. Wh.	CMC	230	1150
300	G.E.	MPC	230	275/550
270	Whse.		500	250/400
250	Al. Ch.		230	525
200	Whse.		230	400
175	Whse.	SK	250	150/525
150	G.E.	RC-19A	230	800/1000
150	Whse.	SK-201	230	300/900
150	G.E.	MPC	230	250/450
125	G.E.	CO-1832	230	625
120	Whse.	SK-180	230	720
100	G.E.	LC-50	230	1200
100	Al. Ch.		230	950/1150
100	G.E.	RC-19	230	575/720.
75	G.E.	LC	230	500/1000
75	Whse.	SK	230	475/900
60	El. Dy.	258	230	525/1050
50/60	Cr. Wh.	65H	230	500/1000
50	G.E.	RC-16	230	650/815

TRANSFORMERS

KVA	Make	PH	Type	Voltages
1000	Pitts.	1	OISC	2300/4600x575
1000	G.E.	1	HKDD	13800x2300
300	G.E.	1	H	13200x2300/575
200	Whse.	1	SK	6900x230/460
200	G.E.	1	H	26400x115/460
100	Whse.	1	OISC	13200x250

GEAR UNITS

2100 HP Whse., 1800/375 RPM.
943 HP GE 5306/1200 RPM.
730 HP DeLaval 5000/600 RPM.

MOTOR GENERATOR SETS

3 ph. 60 cycle

1—1500 KW GE 600 V. DC, Gen. dc. to 2100 HP—6600 V. Syn. Motor with exciter.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
2—250 KW GE 250 V. Gen. d.c. to 375 HP—2200 V. Syn. Motor.

TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.
1—500 KW, G.E., 625 KVA, 2300 V., 3 ph., 60 cy. generator with Curtis 4 stage, 150 pound condensing turbine complete with condenser, etc.

ROTARY CONVERTERS

60 cycle

2—1500 KW, Whse. 720 RPM 650 V. DC with 3-single phase, 33000 V. transformers and panel.
1—1250 KW, G.E., 720 RPM 250 V. DC with 1375 KVA, 3 ph., 2300 V. Transformers and Panels.
2—750 KW, Whse., 1200 RPM, 600 V. DC with 2300/6600/11000 volts Transformers and Panels.
1—750 KW, Whse. 720 RPM 250 V. DC with three phase 6600/2300 V. Transformer and Panels.
1—375 KW, Whse. 1200 RPM 250/275 V. DC with 2200/6600 V. Transformer and Panels.
1—300 KW, G.E., type HCC, 1200 RPM, DC, 600 V. AC 6 ph., 1200 RPM.

25 cycle

3—1500 KW, G.E., 225/275 V. DC Booster type each with 1600 KVA, 3 ph. 6765 volt Transformers and Panels.
1—500 KW, G.E., 225/275 DC Booster type with 500 KVA 3 ph. 6765 volt Transformer and Panels.

A. C. MOTORS

3 ph. 60 cycle

Synchronous

	HP	Make	Type	Volts	Speed
1—	500	G.E.	TS	440	360
1—	250	G.E.	ATI	220	450
1—	225	G.E.	ATI	240	600
1—	200	Whse.		440	514
1—	150	G.E.	TRB	220x440	450
1—	150	Whse.	G	2300	900
1—	150	Whse.		2200/550	1800
1—	125	G.E.	ATI	240	257

Slip Ring

1—	800	Al. Ch.		440	885
1—	600	G.E.	IM	2200	900
1—	450	Whse.	CW	2200	875
1—	400	G.E.	MT	550/440	300
1—	400	Al. Ch.		2300	505
1—	400	Al. Ch.		440	1200
1—	350	G.E.	IM	2300/4000	257
1—	300	G.E.	IM	2300	585
1—	250	G.E.	MT-410	2300	400
1—	250	G.E.	MT	4000/2300	257
2—	200	Whse.	CW	2200	514

Squirrel Cage

1—	500	G.E.	1-17B	2200	695
1—	300	Whse.	CS	550	550
2—	300	G.E.	1K	2300	600
1—	300	Al. Ch.		2200	1160
1—	250	Al. Ch.		220/440	1150

SINE WAVE SET

Main unit—GE 3 unit, 4 Brg. consisting of motor—15/35 HP, 750/1800 RPM, 230 V. DC Gen.—15 KW—220/110 V., 1800 RPM—3 ph., 60 cy.
Ref. Gen.—5 KW—36/18 V., 1800 RPM, 3 ph., 60 cy., with stator shifting.
Complete with Exciter Set, Voltage regulator, panels and accessories.

RE-NU-BILT BELYEA MOTORS

What are your requirements? units up to 5000 kw available in stock.

BELYEA COMPANY INC.

Main Office & Shop: 51 HOWELL ST., JERSEY CITY, N. J.

J.L.HEMPHILL & CO. Inc.

ELECTRICAL ENGINEERS AND EQUIPMENT

1602 53rd Street, North Bergen, N. J.

N. Y. C. Tel.: LOngacre 5-3227—N. J. Tel.: UNion 3-2600

MOTOR—3 PHASE 60 CYCLE

1—5000 ampere, 6 volt, Hanson-Van Winkle
1—2000 ampere, 6 volt, Hanson-Van Winkle
1—1500 ampere, 6 volt, Hanson-Van Winkle
1—500 HP, 900 RPM, 440 volt, Lincoln slip ring
1—400 HP, 514 RPM, 440 volt, Westg., slip ring.
1—335 HP, 600 RPM, 2300 volt, G.E. syn.
1—300 HP, 900 RPM, 440 volt Lincoln slip ring.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v, G.E., sl. rg.
1—150 HP, 1800 RPM, 2300 volt, Al. Ch. sq. cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
2— 75 HP, 1200 RPM, 2200 volt, G.E., vertical.

MOTORS—D. C. 230 VOLTS

2— 450 HP, 400 RPM, General Electric MPL.
1— 250 HP, 760 RPM, Electro Dynamic.
2— 150 HP, 550 RPM, Westinghouse, SK.
1— 120 HP, 750 RPM, Electro Dynamic.
1— 125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1— 65 HP, 1000 RPM, G.E., type RC.
1— 50 HP, RPM, Westinghouse, type SK.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—250 KVA, General Electric 6600/2200/220/440
3—200 KVA, General Electric 2200/220/440.
3—200 KVA, G.E., 2200-220/440 volts.
3—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
3—100 KVA, G.E., 2200-220/110 volts.
3—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3— 75 KVA, General Electric 2200/220/440.

MOTORS GENERATOR SETS

1—750 KW, 250 volt, Allis Chalmers, synchronous
1— 75 KW, 125 volt, Crocker Wheeler, synchronous
1— 35 KW, 125 volt, Elec. Machinery, sq. cage

MOTORS—VARIABLE SPEED 230 VOLTS

1—750 KW, 250 volt Allis-Chalmers synchronous
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—225 KVA, 514 RPM, 600 volt, Westinghouse.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chalmers.

TURBO-GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

ENGINE GENERATOR SETS

1—150 KVA, General Electric Generator, Ames Uniflow engine.
1—62½ KVA, Westinghouse Generator, Fairbanks Company engine.

Complete Line of A.C. and D.C. Motors and Generators

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies.

POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list, . . . to

APPARATUS EXCHANGE
EBASCO SERVICES INCORPORATED
Two Rector St. New York, N. Y.

At your service . . .

The Searchlight Section brings business needs and "opportunities" to the attention of men associated in executive, management, sales and responsible technical, engineering and operating capacities with the industries served by these McGraw-Hill publications. USE IT.

Departmental Staff
McGraw-Hill Publishing Co., New York

American Machinist
Aviation
Business Week
Bus Transportation
Chem. & Met. Eng.
Coal Age
Construction Methods
Electrical Contracting
Electrical Merch.
Electrical World
Electronics
Engineering & Min. Jour.
Engineering News-Record
E. & M. J. Markets
Factory Mgt. & Maintenance
Food Industries
Power
Product Engineering
Textile World

WANTED

WILL PURCHASE

Any quantity Fractional H-P Motors for Cash

Fractional H-P Motors—Always in Stock

H. U. MANN CO.
540 Lake Shore Drive CHICAGO

Alphabetical Index to Advertisers

Acme Electric & Mfg. Co. 158
*Allen-Bradley Company 19, 20
*Allis-Chalmers Mfg. Co. 10, 11
Aluminum Company of America.. 49
American Bridge Company..... 37
American Cyanamid Company, Plastics Division 121
American Fork & Hoe Co..... 163
*American Transformer Co..... 140
Anaconda Wire & Cable Co..... 125
*Artkraft Sign Co., The..... 142
Automatic Alarms Incorporated... 154

Barker & Wheeler..... 164
*Bell Lumber & Pole Co..... 17
*Bendix Aviation Corp., Marine Division 120
*Bentley, Harris Mfg. Co..... 14
*Biddle Co., James G..... 124
Black & Veatch..... 164
Blaw-Knox Co. 27
*Bright Light Reflector Co., Inc... 146
*Burndy Engineering Co..... 21

*Chance Company, A. B..... 128
Chase-Shawmut Company, The.... 61
Cheney & Co., E. J..... 164
Coffing Hoist Co..... 160
Columbia Engineering Corp..... 164
Combustion Engrg. Co., Inc....40, 41
*Connecticut Hard Rubber Co., The 162
Consolidated Treating Co..... 43
*Continental-Diamond Fibre Co.... 30
Cooper & Co., Inc., Hugh L..... 164
*Cope, Inc., T. J..... 158
Crescent Insulated Wire & Cable Co. 22

Davis, Julien H..... 164
Day & Zimmermann, Inc..... 164
Deutschmann Corp., Tobe..... 131
Directory of Engineers..... 164
*Driver Co., Wilbur B..... 119

Ebasco Services Inc..... 164
Electric Controller & Mfg. Co., The 115, 116
Electric Storage Battery Co..... 56
*Electrical Engineers Equipment Co. 28, 29
Electrical Testing Laboratories Inc. 164
Elliott Company 6
Engineers, Directory of..... 164
Everstick Anchor Co..... 162

Federal Electric Products Co..... 144
Ferguson, H. F..... 164
Foley Construction Corp., Robert E. 164
Ford, Bacon & Davis, Inc..... 164
Foster Wheeler Corp..... 35
Fowle & Co., Frank F..... 164

*G. C. A. Mfg. Co., The..... 160
G & W Electric Specialty Co..... 32
General Cable Corporation....100, 101
*General Electric Co.....91, 93, 95, 96, 97, 99
Gilbert Associates, Inc..... 164

Gould Storage Battery Corp..... 18
*Graybar Electric Co..... 5
*Greenlee Tool Co..... 156
Grinnell Company, Inc..... 122
*Guth Co., The Edwin F..... 134

Handy & Harman..... 159
*Hazard Insulated Wire Works.... 4
Henkels & McCoy..... 164
Hoosier Engineering Co..... 164
Hotpoint 8
Hubbard & Co..... 137

*Illinois Electric Porcelain Co..... 23
*Imperial Porcelain Works..... 158
Indiana Steel & Wire Co..... 138
*Irvington Varnish & Insulator Co.. 60
*I-T-E Circuit Breaker Co...Third Cover

*Johns-Manville 52

Kelvinator Division of Nash-Kelvinator Corp. 129
Kidde & Co., Inc., Walter..... 36
*Klein & Sons, Mathias..... 151
*Krueger & Hudepohl..... 162
*Kuhlman Electric Co.....Back Cover

*Lapp Insulator Co..... 39
Leffler, William S..... 164
Line Material Co..... 103

*Macallen Company, The..... 58
Main, Inc., Chas. T..... 164
Malleable Iron Fittings Co..... 156
Mallory & Co., Inc., P. R..... 44
Manning & Co., J. H..... 164
Matthews Corp., W. N.....161, 163
McGraw-Hill Book Co., Inc....158, 161
Mead, Daniel W..... 164
*Metropolitan Device Corp. Second Cover
*Moloney Electric Co..... 143
*Monitor Controller Company, The. 38
Mosinee Paper Mills Company.... 123
Mullergren, Arthur L..... 164

National Electric Products Corp... 62
National Telephone Supply Co.... 147
*National Varnished Products Corp., The 160
*Newport News Shipbuilding and Dry Dock Co..... 48

Ohio Brass Co..... 9
*Okonite Co. 4
*Okonite-Callender Cable Co..... 4
*Oliver Iron & Steel Corp..... 53
Osmose Wood Preserving Co. of America, Inc. 157
*Owens-Corning Fiberglas Corp..... 109

*Pacific Electric Mfg. Corp..... 16
Paragon Electric Company..... 157
*Penn-Union Electric Corp..... 150
Pittsburgh Reflector Co..... 130
Proctor Electric Company..... 127

*Railway & Industrial Engineering Co. .....
RCA Mfg. Co., Inc.....
Recording & Statistical Corp..... 164
*Reliable Electric Co..... 159
*Rockbestos Products Corporation.. 10
Rome Cable Corp..... 25

Sanderson & Porter..... 164
Sargent & Lundy..... 164
Scheidenhelm, F. W..... 164
Searchlight Section 165, 166, 167
Sheldon Service Corporation..... 153
Shell Oil Co..... 135
Simplex Wire & Cable Co..... 45
Socony-Vacuum Oil Co., Inc..... 15
*Standard Transformer Co.....50, 51
*Star Porcelain Co..... 160
*Sticht Co., Inc., Herman H..... 160
Stone & Webster Engrg. Corp..... 164
Superior Electric Company..... 107
*Sylvania Electric Products Inc...54, 55

Texas Co., The..... 24
Timber Engineering Co..... 113

*United States Rubber Co.....110, 111
*United States Steel Corp.....37, 147
United States Steel Supply Co..... 145

*Victor Insulators, Inc..... 154

Wagner Electric Corp..... 52
Welsbach Engrg. & Mgt. Corp..... 164
*Westinghouse Elec. & Mfg. Co...13, 28, 33, 46, 47, 59, 139
*Westinghouse Elec. & Mfg. Co., Lamp Division 132, 133
*Westinghouse Elec. Supply Co..... 153
White Engineering Corp., J. G.... 164
Wickwire Spencer Steel Co..... 12
Wiremold Company, The..... 34
*Wolverine Tube Division, Calumet and Hecla Consolidated Copper Co. 42

■

PROFESSIONAL SERVICES 164

■

SEARCHLIGHT SECTION

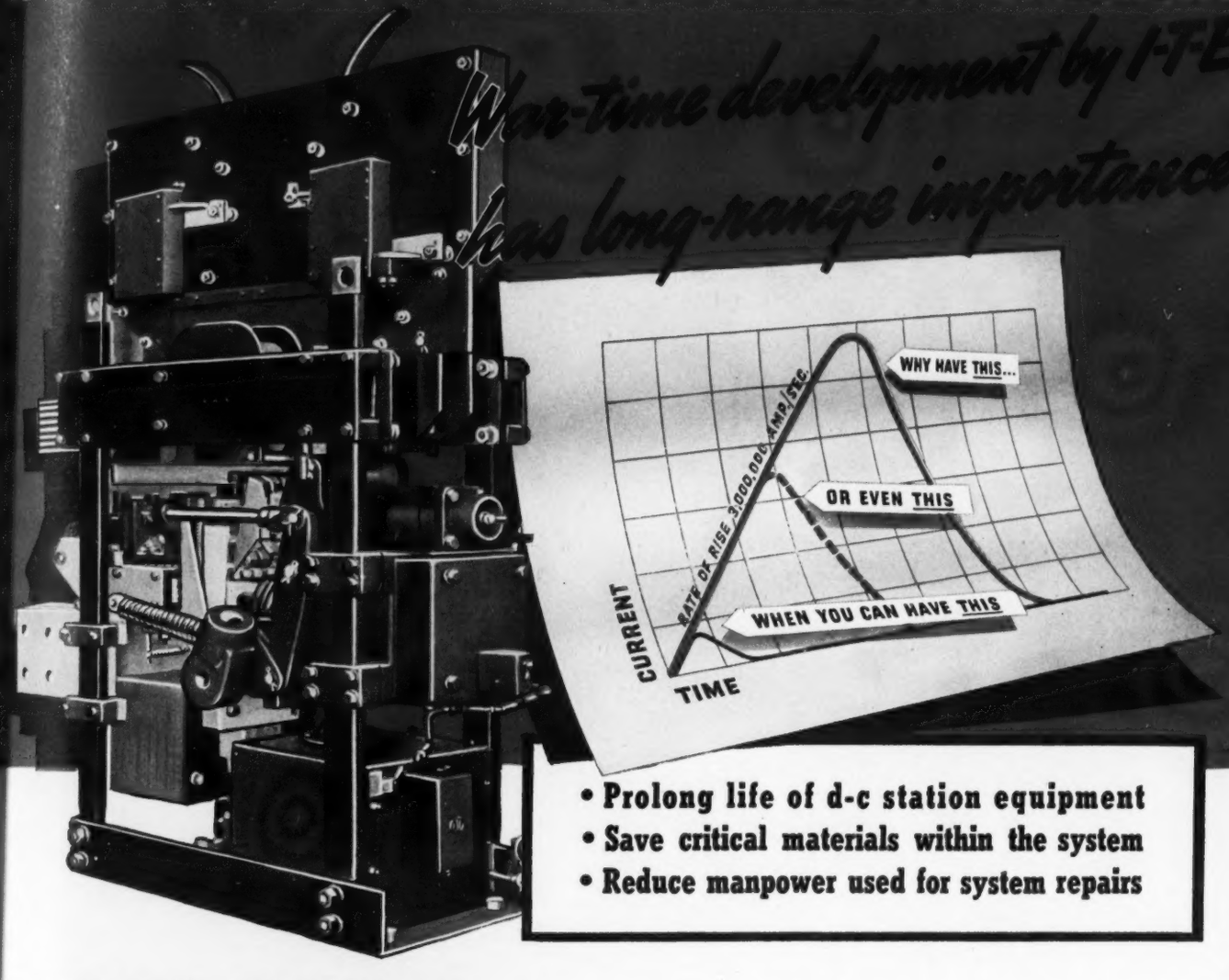
(Classified Advertising)

BUSINESS OPPORTUNITIES 166
EMPLOYMENT SERVICE 165
POSITIONS VACANT 165
POSITIONS WANTED 166
SELLING OPPORTUNITIES 166
WANTED TO PURCHASE.....166, 167
USED AND SURPLUS EQUIPMENT.....166, 167
Belyea Co., Inc.....167
Brew, Woltman & Co.....166
Chicago Electric Co.....166
Coleman Bros. Corp.....166
Ebasco Services, Inc.....167
Electric Service Co., The.....166
Hemphill & Co., J. L.....167
Huberman, Samuel 166
Mann, H. U.....167

★ **These companies have supplied additional buying information on their products in the 1943 edition of the Electrical Buyers' Reference**

ULTRA-HIGH-SPEED D-C CIRCUIT BREAKERS

War-time development by I-T-E has long-range importance



- **Prolong life of d-c station equipment**
- **Save critical materials within the system**
- **Reduce manpower used for system repairs**

IN THE FIRST DAYS OF THE WAR, need arose for controlling the extremely high fault currents which threatened industrial d-c systems, particularly where generators, converters or rectifiers were connected in parallel. Currents rising at rates of several million amperes per second were capable of causing—and did cause—serious outages with losses in production, waste of station materials and disruption of manpower schedules.

Prior to the war, I-T-E had been working with ultra-high-speed circuit breakers for d-c application. Circuit breakers had been developed and installed which were successful in limiting fault currents to very low values. Fast opening--faster than any heavy-duty circuit breakers had ever achieved--was the answer to the problem. It was the answer when I-T-E adapted design to specific war-time needs. *It is the answer from here on!*

In the future, as now, ultra-high-speed circuit breakers will prolong life of d-c station equipment by removing the hazard of extremely heavy currents. Systems will contain less metal; bus runs will have simpler supporting structures. There will be less maintenance. The circuit breakers themselves will use less material and will have longer life.

• • •

The d-c circuit breaker shown above, the Type FB, has opening characteristics which limit currents within 2/5ths of a cycle (60 cycle basis). The black curve on the chart is drawn from an oscillogram.

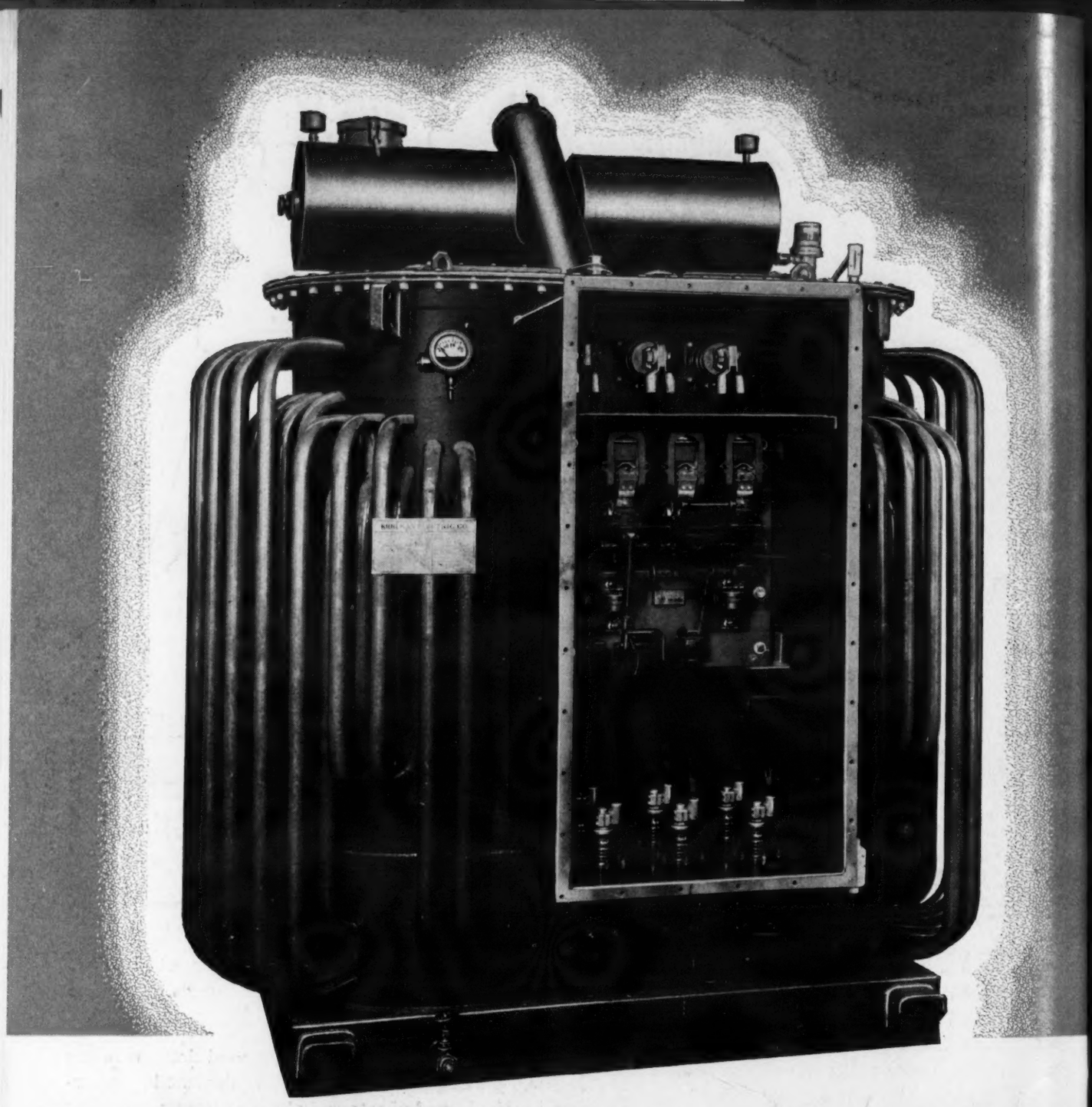
I-T-E

AIR SWITCHGEAR

IMMERSED IN AIR • ENCASED IN STEEL

Representatives in Principal Cities

CIRCUIT BREAKER CO., PHILADELPHIA, PA.



This Ruggedly Built Kuhlman Power Transformer Possesses Many Special Features . . .

In these days when the efficiency of America's power distribution is especially vital, many an unusual and specially designed transformer is going to work directly or indirectly for Uncle Sam. The 1,000 KVA Kuhlman transformer shown here is an example. It is a 3 phase, 60 cycle, OISC Transformer rated 13,800 Delta —480 Delta volts. • The box mounted on the low voltage side contains a 3-pole, 3-coil circuit breaker with time delay, trip shunt and over current trip coil. Rated 600 amperes. This unit is also equipped with a low-level alarm, a conservator tank, a primary junction box with 3-1 conductor potheads and an alarm type thermometer in addition to all the other accessories usually built into a Kuhlman Power Transformer. Whether you need a special transformer or any other type of Power, C.S.P., Distribution or SAF-T-KUHL Transformer or line regulator it will pay you to get facts and prices from Kuhlman.

Kuhlman

ELECTRIC COMPANY

BAY CITY, MICHIGAN